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Foreword

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The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

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  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the stage 3 protocol and data model for the Ntsctsf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the TSCTSF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [4] and 3GPP TS 29.501 [5].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[5] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[6] OpenAPI: "OpenAPI Specification Version 3.0.0", https://spec.openapis.org/oas/v3.0.0.

[7] 3GPP TR 21.900: "Technical Specification Group working methods".

[8] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[9] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

[10] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

[11] IETF RFC 9113: "HTTP/2".

[12] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

[13] IETF RFC 9457: "Problem Details for HTTP APIs".

[14] 3GPP TS 29.534: "5G System; Access and Mobility Policy Authorization Service; Stage 3".

[15] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces Stage 3".

[16] 3GPP TS 29.508: "5G System; Session Management Event Exposure Service; Stage 3".

[17] 3GPP TS 29.522: "5G System; Network Exposure Function Northbound APIs; Stage 3".

[18] IEEE Std 802.1Q-2018: "IEEE Standard for Local and metropolitan area networks--Bridges and Bridged Networks".

[19] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System".

[20] 3GPP TS 29.514: "5G System; Policy Authorization Service; Stage 3".

[21] 3GPP TS 29.122: "T8 reference point for northbound Application Programming Interfaces (APIs)".

[22] IETF RFC 7396: "JSON Merge Patch".

[23] 3GPP TS 29.521: "5G System; Binding Support Management Service; Stage 3".

[24] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[25] IEEE Std 1588-2019: "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control".

[26] IEEE Std 802.1AS-2020: "IEEE Standard for Local and metropolitan area networks--Timing and Synchronization for Time-Sensitive Applications".

[27] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[28] IETF RFC 9633: "Deterministic Networking (DetNet) YANG Data Model".

[29] IETF RFC 6241: "Network Configuration Protocol (NETCONF)".

[30] IETF RFC 8040: "RESTCONF Protocol".

[31] 3GPP TS 29.513: "5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".

[32] IETF RFC 8939: "Deterministic Networking (DetNet) Data Plane: IP".

[33] IETF RFC 7950: "The YANG 1.1 Data Modeling Language".

[34] IETF RFC 8407: "Guidelines for Authors and Reviewers of Documents Containing YANG Data Models".

[35] IETF RFC 6020: "YANG – A Data Modeling Language for the Network Configuration Protocol (NETCONF)".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

Void

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Void

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

ASTI Access Stratum Time distribution

BAT	Burst Arrival Time
DetNet	Deterministic Networking
DS-TT	Device-side TSN translator
NW-TT	Network-side TSN translator
PTP	Precision Time Protocol
TA	Tracking Area
TSC	Time Sensitive Communication
TSCAI	TSC Assistance Information
TSCTSF	Time Sensitive Communication and Time Synchronization function

4 Overview

4.1 Introduction

The Ntsctsf services are offered by the TSCTSF to support the Time Sensitive Communications and Time Synchronization.

The following Ntsctsf services are specified:

- Ntsctsf_TimeSynchronization service;
- Ntsctsf_QoSandTSCAssistance service.
- Ntsctsf_ASTI service.

To enable the reporting of 5GS DetNet node configuration and the provisioning and configuration data for DetNet flows, the TSCTSF offers RESTCONF (IETF RFC 8040 [30]) and/or NETCONF (IETF RFC 6241 [29]) interfaces to the DetNet controller to access the 3GPP extended Deterministic Networking (DetNet) YANG Model as specified in Annex B.

4.2 Service Architecture

The 5G System Architecture is defined in 3GPP TS 23.501 [2].

The known NF service consumers of the Ntsctsf services are the Application Function (AF) within the operator's trust domain and the Network Exposure Function (NEF).

The Ntsctsf services are provided by the TSCTSF and consumed by the NF service consumers (e.g. AF, NEF), as shown in figure 4.2-1 for the SBI representation model and in figure 4.2-2 for the reference point representation model.

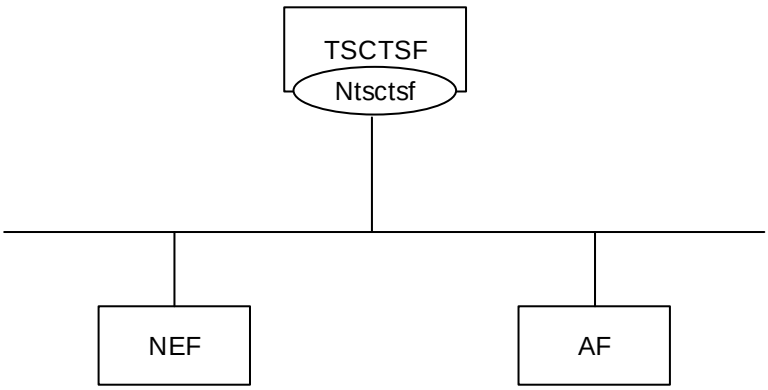

Figure 4.2-1: Ntsctsf services architecture, SBI representation

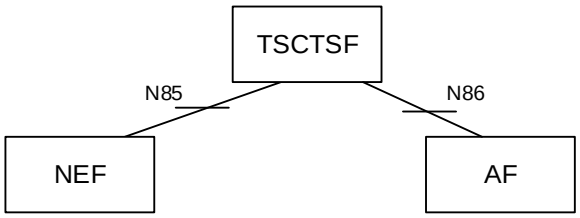

Figure 4.2-2: Ntsctsf services architecture, reference point representation

The DetNet controller, as specified in clause 4.4.8.4 of 3GPP TS 23.501 [2], is the TSCTSF's consumer that accesses the 3GPP extended DetNet YANG model, as specified in Annex B, clause B.1.1.

5 Services offered by the TSCTSF

5.1 Introduction

Table 5.1-1 summarizes the corresponding APIs defined for this specification.

Table 5.1-1: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Ntsctsf_TimeSynchronization	6.1	Provides the support to subscribe/unsubscribe to the notification about time synchronization capabilities or changes in time synchronization status information. Also allows to activate and deactivate the time synchronization configuration.	TS29565_Ntsctsf_TimeSynchronization.yaml	ntsctsf-time-sync	A.2
Ntsctsf_QoSandTSCAssistance	6.2	Provides the support to request specific QoS and provide assistance for handling traffic characterized by TSC QoS parameters.	TS29565_Ntsctsf_QoSandTSCAssistance.yaml	ntsctsf-qos-tscai	A.3
Ntsctsf_ASTI	6.3	Provides support for time synchronization service based on 5G access stratum time distribution method. Allows the NF consumer to configure the 5GC and RAN for 5G access stratum based time synchronization service for the UEs and subscribe to get informed about changes in time synchronization status information.	TS29565_Ntsctsf_ASTI.yaml	ntsctsf-asti	A.4

5.2 Ntsctsf_TimeSynchronization Service

5.2.1 Service Description

5.2.1.1 Overview

This service provides:

- Authorization of NF Service Consumer requests for the subscription to the notification of the capability of time synchronization service.
- Authorization of NF Service Consumer requests to create and update time synchronization configuration, and to activate and deactivate the time synchronization service as described in clause 5.27.1.8 of TS 23.501 [2].

NOTE: The AF can use either the procedure specified in bullet2) for configuring the (g)PTP instance in 5GS or the procedure specified in clause 5.4.2.2 for controlling the 5G access stratum time distribution for a particular UE. The procedures are not intended to be used in conjunction with each other by the AF. However, the (g)PTP instance activation, modification, and deactivation can influence the 5G access stratum time distribution for the UEs that are part of the impacted PTP instance.

- Detection and reporting of time synchronization service status based on gNB and/or UPF/NW-TT timing synchronization status information and reporting status updates.
- Notifications to the NF service consumer about the state and changes of state of time synchronization configuration due to evaluation of e.g. time synchronization coverage area conditions.

5.2.1.2 Network Functions

5.2.1.2.1 TSCTSF

The TSCTSF supports to:

- receive the request to create/update the subscription to the notification of the capability of time synchronization service from the NEF or AF and interact with the related PCF;
- receive the request to delete the subscription to the notification of the capability of time synchronization service from the NEF or AF and remove the information from the related PCF;
- receive the notification of the availability of the user plane node information from the PCF and subscribe the notification of user plane node related events at the PCF;
- makes a translation from External/Internal Group Identifier to a list of SUPI by querying UDM;
- retrieve the Time Synchronization Subscription data from UDM for the control of (g)PTP instance(s) and compare with the received the Time Synchronization Subscription data to make decision for AF request is authorized or not;
- determine the capability of time synchronization service based on the capability information received from the DS-TT(s) and NW-TT and notify the NEF or AF of the capability;
- receive the request to create or modify the time synchronization configuration from the NEF or AF, configure and initialize the PTP instance(s) by constructing a PMIC to each DS-TT/UE to activate the time synchronization service in DS-TT and PMIC(s) and UMIC to NW-TT to activate the time synchronization service in NW-TT and provision them to the PCF;
- determine whether the UE is inside/outside the authorized time synchronization coverage area and/or within the authorized time period and enforce the time synchronization service accordingly;
- notify the NEF or AF of the current state of the time synchronization service configuration;
- receive the request of time synchronization deactivation from the NEF or AF and disable the corresponding PTP instance(s) in the DS-TT(s) and NW-TT.

- indicate whether the (g)PTP service is supported or not as per the requested acceptance criteria (e.g., based on the known timing synchronization status attribute thresholds pre-configured at gNB); and based on gNB and/or UPF/NW-TT timing synchronization status (degradation/failure/improvement) information and reporting provides a notification when there is a service status update if the NEF or AF subscribe to service status updates.

5.2.1.2.2 NF Service Consumers

The NF service consumer supports to:

- send the request to create/update and delete the subscription to the notification of the capability of time synchronization service to TSCTSF;
- receive the notification of the capability of time synchronization service;
- send the request to create, modify and delete the time synchronization configuration to the TSCTSF;
- provide clock quality reporting control information, consisting of clock quality detail level and clock quality acceptance criteria during activation or modification of time synchronization service to subscribe to time synchronization service status for the target UE(s).

5.2.2 Service Operations

5.2.2.1 Introduction

Service operations defined for the Ntsctsf_TimeSynchronization service are shown in table 5.2.2.1-1.

Table 5.2.2.1-1: Ntsctsf_TimeSynchronization Service Operations

Service Operation Name	Description	Initiated by
Ntsctsf_TimeSynchronization_CapsSubscribe	Allows the NF service consumer to create or modify a subscription to the notification about the capability of time synchronization service for a list of UEs a group of UEs or any UE using a DNN/S-NSSAI combination.	NF service consumer (e.g. AF, NEF)
Ntsctsf_TimeSynchronization_CapsUnsubscribe	Allows the NF service consumer to delete the subscription to the notification about capability of time synchronization service for a list of UEs, a group of UEs or any UE using a DNN/S-NSSAI combination.	NF service consumer (e.g. AF, NEF)
Ntsctsf_TimeSynchronization_CapsNotify	Allows the TSCTSF to notify the NF service consumer of the capability of time synchronization service.	TSCTSF
Ntsctsf_TimeSynchronization_ConfigCreate	Allows the NF service consumer to create a time synchronization configuration.	NF service consumer (e.g. AF, NEF)
Ntsctsf_TimeSynchronization_ConfigUpdate	Allows the NF service consumers to update the time synchronization configuration.	NF service consumer (e.g. AF, NEF)
Ntsctsf_TimeSynchronization_ConfigDelete	Allows the NF service consumer to delete the time synchronization configuration.	NF service consumer (e.g. AF, NEF)
Ntsctsf_TimeSynchronization_ConfigUpdateNotify	Allows the TSCTSF to notify the NF service consumer of the state of time synchronization configuration.	TSCTSF

NOTE: The NEF and the AF use the Ntsctsf_TimeSynchronization service in the same way.

5.2.2.2 Ntsctsf_TimeSynchronization_CapsSubscribe

5.2.2.2.1 General

This service operation is used by an NF service consumer to subscribe to notification of capability of time synchronization service for a list of UEs, a group of UEs or any UE using a DNN/S-NSSAI combination.

The following procedures using the Ntsctsf_TimeSynchronization_CapsSubscribe service operation are supported:

- creating a new subscription;
- modifying an existing subscription.

5.2.2.2.2 Creating a new subscription

Figure 5.2.2.2.2-1 illustrates the creation of a subscription.

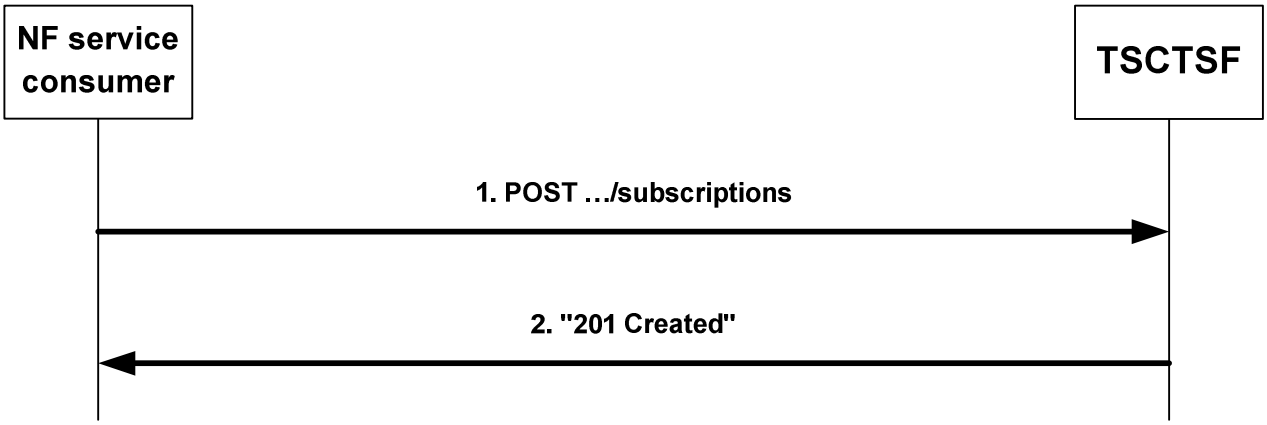

Figure 5.2.2.2.2-1: Creation of a subscription

To subscribe the notification of the capability of time synchronization service, the NF service consumer shall send an HTTP POST message to the TSCTSF to the URI "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions". The HTTP POST message shall include the TimeSyncExposureSubsc data structure as request body. The TimeSyncExposureSubsc data structure shall include:

- the indication of the UEs to which the time synchronization capabilities is requested via:
  - identification of a list of individual UEs within a "supis" attribute; or
  - identification of a list of individual UEs within a "gpsis" attribute; or
  - indication of any UE within the "anyUeInd" attribute; or
  - identification of a group of UE(s) within the "interGrpId" attribute; or
  - identification of a group of UE(s) within the "exterGrpId" attribute.
- subscription to event(s) notification as "subscribedEvents" attribute;
- notification URI within the "subsNotifUri" attribute;
- notification correlation Id within the "subsNotifId" attribute;
- DNN with the "dnn" attribute; and
- S-NSSAI with the "snssai" attribute;

and may include:

- the conditions to match for notifying the event within the "eventFilters" attribute;
- notification method within the "notifMethod" attribute
- maximum number of reports within the "maxReportNbr" attribute;
- expiry time within the "expiry" attribute; and
- report period within the "repPeriod" attribute.

Upon receipt of the HTTP request from the NF service consumer, if the request is authorized, the TSCTSF shall:

- create a new subscription;
- assign a subscription correlation ID;
- select an expiry time that is equal to or less than the expiry time potentially received in the request;
- store the subscription;
- if the "interGrpId" attribute or "exterGrpId" attribute is received from the NF service consumer, interact with the UDM to retrieve the SUPI list that belong to the group using the Nudm_SDM service as defined in 3GPP TS 29.503 [24];
- if the "gpsis" attribute is received from the NF service consumer, interact with the UDM to retrieve the SUPI(s) that correspond to the GPSI(s) using the Nudm_SDM service as defined in 3GPP TS 29.503 [24];
- use the parameters received from the NF service consumer (i.e. DNN, S-NSSAI and, if available, the list of Ues or Ues that belong to the group of Ues) and the time synchronization subscription data retrieved from UDM to determine the matching AF-session(s) that are authorized by subscription, and for any such AF-session, interact with the PCF by triggering Npcf_PolicyAuthorization_Create/Update request message as defined in 3GPP TS 29.514 [20].

NOTE 1: If the PCF determines an existing PDU Session is potentially impacted by time synchronization service (based on local configuration or SM Policy Association), the PCF invokes Npcf_PolicyAuthorization_Notify service operation to the TSCTSF as defined in clause 4.2.5.16 of 3GPP TS 29.514 [20] to send the received TSC User Plane Node information. At that time, the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities as SUPI and if available, GPSI for the notified PDU session), as specified in 3GPP TS 29.521 [23], and can create the AF-session by sending to the PCF the Npcf_PolicyAuthorization_Create service operation.

- send an HTTP "201 Created" response with TimeSyncExposureSubsc data structure as response body and a Location header field containing the URI of the created individual subscription resource, i.e. "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}".

The TSCTSF shall handle the AF session(s) associated with the "Individual Time Synchronization Exposure Subscription" resource as follows:

- For the association of AF sessions to "Individual Time Synchronization Exposure Subscription" resources:

  a. Upon PDU Session establishment, i.e. when the TSCTSF receives the Npcf_PolicyAuthorization_Notify service operation for the establishment of a new PDU session, the TSCTSF shall retrieve from the BSF, as specified in 3GPP TS 29.521 [23], the PCF binding information to complete the necessary AF-Session information and triggers the Npcf_PolicyAuthorization_Create request message to the PCF to create an AF-session to subscribe to TSC user plane node related events. The TSCTSF, shall use the parameters of existing "Individual Time Synchronization Exposure Subscription" resources to determine whether they shall be associated to this newly created AF session. The TSCTSF associates the new AF session to the "Individual Time Synchronization Exposure Subscription" resources for which these parameters match. The TSCTSF shall read time synchronization capabilities from the DS-TT and NW-TT, if not available in the AF session, from the PCF by triggering Npcf_PolicyAuthorization_Update request message as defined in 3GPP TS 29.514 [20] and determine the (g)PTP capabilities from the DS-TT and the NW-TT as described in clause K.2.1 of 3GPP TS 23.501 [2]. The TSCTSF shall update the time synchronization service capability for this new DS-TT as defined in clause 5.2.2.4.2.

  b. Upon AF sessions establishment, i.e. when the TSCTSF receives the AF request for the time synchronization service, the TSCTSF shall retrieve Time Synchronization Subscription data from UDM. The TSCTSF, shall use the parameters of existing "Individual Time Synchronization Exposure Subscription" resources to determine whether they shall be associated to this newly created AF session. The TSCTSF associates the new AF session to the "Individual Time Synchronization Exposure Subscription" resources for which these parameters match if the AF-session (i.e., the SUPI) is authorized by UDM subscription, otherwise the AF-session is excluded.

  c. Upon "Individual Time Synchronization Exposure Subscription" resource creation, the TSCTSF uses the parameters of the created resource to determine which existing and authorized AF sessions it matches. The

TSCTSF associates the new "Individual Time Synchronization Exposure Subscription" resource to the authorized AF sessions for which these parameters match.

- To remove an authorized AF session from the associated ones to the "Individual Time Synchronization Exposure Subscription" resource, when the TSCTSF receives the Npcf_PolicyAuthorization_Notify service operation indicating the termination of an existing PDU session, the TSCTSF triggers the Npcf_PolicyAuthorization_Delete request message to the PCF and determines if the corresponding AF session is associated with the "Individual Time Synchronization Exposure Subscription" resource. If it is so, the TSCTSF shall remove the AF session from the list of AF session(s) associated with the "Individual Time Synchronization Exposure Subscription" resource. The TSCTSF shall update the time synchronization service capability for this removed DS-TT as defined in clause 5.2.2.4.2.

NOTE 2: After the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], the TSCTSF can store internally the information required to invoke Npcf_PolicyAuthorization_Create service operation and delay the Npcf_PolicyAuthorization_Create service operation (the creation of the AF session) till the subscription to notification of the capability of time synchronization service is received for the concerned authorized UE. In this case, when the TSCTSF receives the subscription request, the TSCTSF interacts with the PCF by triggering Npcf_PolicyAuthorization_Create message as defined in 3GPP TS 29.514 [20].

NOTE 3: When the TSCTSF receives the Npcf_PolicyAuthorization_Notify service operation indicating the termination of an existing PDU session associated to an AF session that it is not associated with any "Individual Time Synchronization Exposure Subscription" resource, the TSCTSF can remove the AF-session and triggers the Npcf_PolicyAuthorization_Delete request message to the PCF.

If the AF request is not authorized and/or the feature "SupportReport" is supported and the UE's Time Synchronization Subscription data indicates that the requested UE(s) are not allowed for AF-provided (g)PTP service, the TSCTSF shall reject the NF service consumer request and include in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE_SERVICE_NOT_AUTHORIZED".

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.1.7.

5.2.2.2.3 Modifying an existing subscription

Figure 5.2.2.2.3-1 illustrates the modification of a subscription.

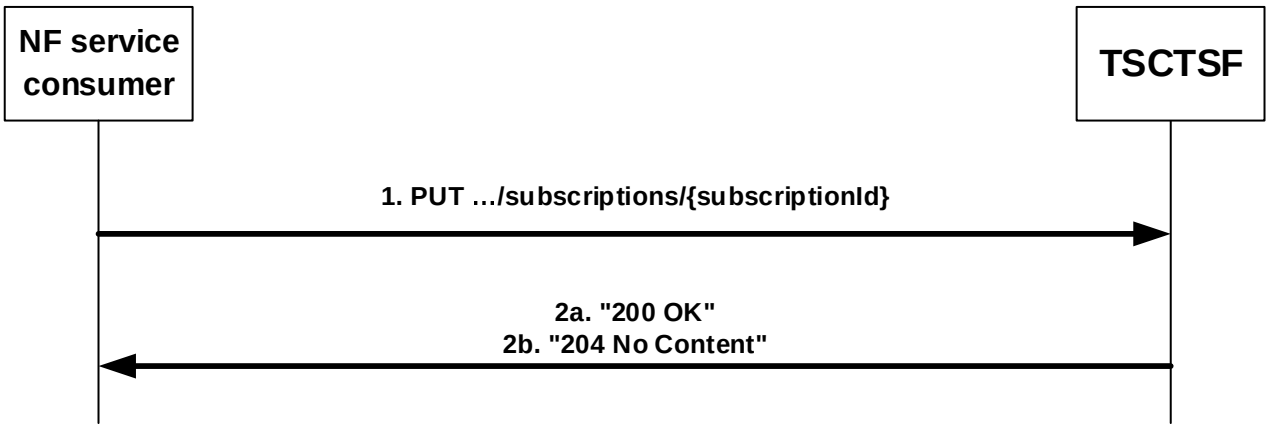

Figure 5.2.2.2.3-1: Modification of a subscription

To modify the subscription to the notification of the capability of time synchronization service, the NF service consumer shall send an HTTP PUT message to the TSCTSF to the URI "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}" representing an existing "Individual Time Synchronization Exposure Subscription" resource, as shown in figure 5.2.2.2.3-1, step 1. The HTTP PUT message shall include the TimeSyncExposureSubsc data structure as request body. The TimeSyncExposureSubsc data structure shall include the parameters as defined in clause 5.2.2.2.2.

Upon receipt of the HTTP request from the NF service consumer, if the request is authorized, the TSCTSF shall:

- update the existing "Individual Time Synchronization Exposure Subscription" resource;

- identify the affected AF session(s) based on the parameters received from the NF service consumer and interact with the PCF by triggering Npcf_PolicyAuthorization_Update request message as defined in 3GPP TS 29.514 [20] for the new added UE(s), by triggering Npcf_PolicyAuthorization_Delete request message as defined in 3GPP TS 29.514 [20] for the removed UE(s) or by triggering Npcf_PolicyAuthorization_Update request message as defined in 3GPP TS 29.514 [20] for the existing UE(s) if necessary.

NOTE 1: If the PCF determines an existing PDU Session is potentially impacted by time synchronization service (based on local configuration or SM Policy Association), the PCF invokes Npcf_PolicyAuthorization_Notify service operation to the TSCTSF as defined in clause 4.2.5.16 of 3GPP TS 29.514 [20] to send the received TSC User Plane Node information. At that time, the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities as SUPI and if available, GPSI for the notified PDU session), as specified in 3GPP TS 29.521 [23], and can create the AF-session by sending to the PCF the Npcf_PolicyAuthorization_Create service operation.

NOTE 2: After the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], the TSCTSF can store internally the information required to invoke Npcf_PolicyAuthorization_Create service operation and delay the Npcf_PolicyAuthorization_Create service operation (the creation of the AF-session) till the subscription to notification of the capability of time synchronization service is received for the concerned UE. In this case, when the TSCTSF receives the subscription request, the TSCTSF interacts with the PCF by triggering Npcf_PolicyAuthorization_Create message as defined in in 3GPP TS 29.514 [20].

- update the list of AF sessions that are associated to the "Individual Time Synchronization Exposure Subscription" resource (i.e. add or remove AF sessions as associated to this resource) based on if the parameters of the AF sessions match the updated parameters of the "Individual Time Synchronization Exposure Subscription" resource.

- send a HTTP response including "200 OK" status code with TimeSyncExposureSubsc data structure or "204 No Content" status code, as shown in figure 5.2.2.2.3-1, step 2.

If the AF request is not authorized and/or the feature "SupportReport" is supported and the UE's Time Synchronization Subscription data indicates that the requested UE(s) are not allowed for AF-provided (g)PTP service, the TSCTSF shall reject the NF service consumer request and include in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE_SERVICE_NOT_AUTHORIZED".

If the HTTP PUT request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP PUT request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP PUT request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.2.2.3 Ntsctsf_TimeSynchronization_CapsUnsubscribe

5.2.2.3.1 General

This service operation is used by an NF service consumer to unsubscribe from the notifications.

The following procedure using the Ntsctsf_TimeSynchronization_CapsUnsubscribe service operation is supported:

- unsubscription from capability notifications.

5.2.2.3.2 Unsubscription from capability notifications

Figure 5.2.2.3.2-1 illustrates the unsubscription from event notifications.

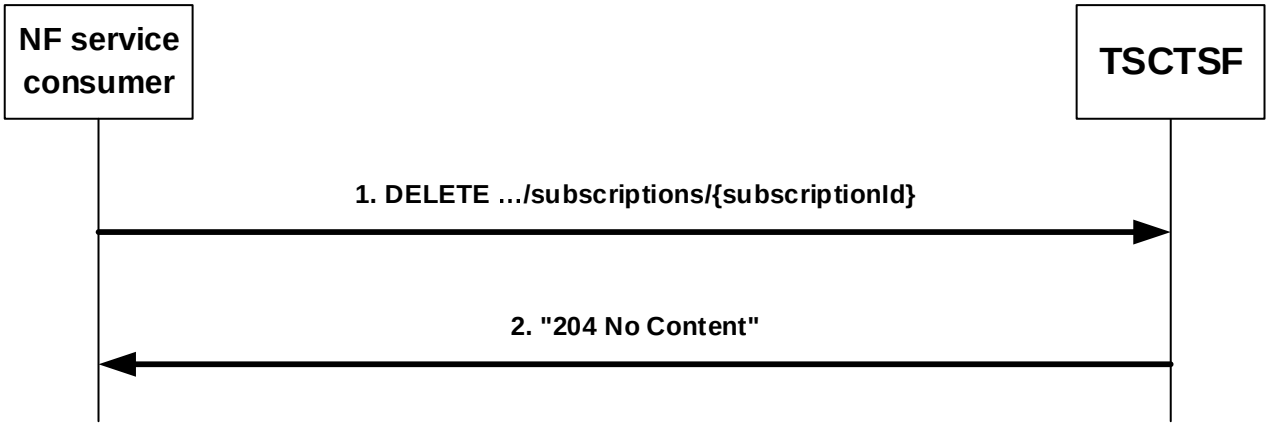

Figure 5.2.2.3.2-1: Unsubscription from capability notifications

To unsubscribe from event notifications, the NF service consumer shall send an HTTP DELETE request with: "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}" as Resource URI, where "{subscriptionId}" is the subscription correlation ID of the existing subscription that is to be deleted.

Upon the reception of the HTTP DELETE request, if the received HTTP request is successfully processed and accepted, the TSCTSF shall:

- remove the corresponding subscription;
- identify the affected AF session(s) and, for each AF session, interact with the PCF by triggering Npcf_PolicyAuthorization_Delete request message as defined in 3GPP TS 29.514 [20]; and
- send an HTTP "204 No Content" response.

If the HTTP DELETE request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP DELETE request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP DELETE request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.2.2.4 Ntsctsf_TimeSynchronization_CapsNotify

5.2.2.4.1 General

This service operation is used by the TSCTSF to send notifications to NF service consumers upon the detection of the capability of the time synchronization service for a list of UEs.

The following procedure using the Ntsctsf_TimeSynchronization_CapsNotify service operation is supported:

- notification about the capability of time synchronization service.

5.2.2.4.2 Notification about the capability of time synchronization service

Figure 5.2.2.4.2-1 illustrates the notification about the capability of time synchronization service.

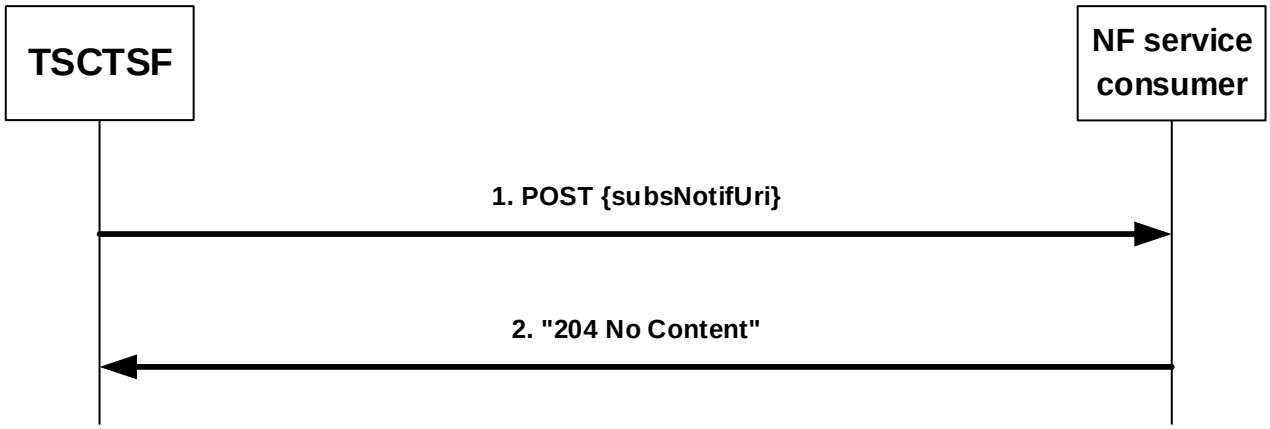

Figure 5.2.2.4.2-1: Notification about the capability of time synchronization service

The TSCTSF maintains the association between the AF session(s) and the Individual Time Synchronization Exposure Subscription resource as defined in clause 5.2.2.2.2 and detects the capability of time synchronization service (for a list of Ues, a group of Ues or any UE in a DNN and S-NSSAI), by composing the time synchronization capabilities for the DS-TT/UE(s) connected to the NW-TT based on the capability information received from the DS-TT(s) and NW-TT via the PCF in the corresponding PMIC(s)/UMIC. If the NF service consumer includes an Event Filter with one or more of the requested PTP instance type, requested transport protocol for PTP, or requested PTP Profile, the TSCTSF considers only the DS-TT(s) and NW-TT(s) with these capabilities as part of the time synchronization capability set that is reported to the NF service consumer. If necessary, when the list of AF session(s) associated to the Individual Time Synchronization Exposure Subscription resource changes, e.g. upon PDU Session establishment or termination, the TSCTSF may notify the update of the capability of time synchronization service for the DS-TT/UE(s) connected to the NW-TT(s). In order to send the capability of time synchronization service to the NF service consumer, the TSCTSF shall send an HTTP POST request with "{subsNotifUri}", as previously provided by the NF service consumer within the corresponding subscription, as request URI and TimeSyncExposureSubsNotif data structure as request body that shall include:

- Notification correlation ID provided by the NF service consumer during the subscription within "subsNotifId" attribute; and
- information about the observed event(s) within the "eventNotifs" attribute that shall contain for each observed event an "SubsEventNotification" data structure that shall include:
    1. the detected event within the "event" attribute;
    2. when the event is "AVAILABILITY_FOR_TIME_SYNC_SERVICE", the capabilities of time synchronization service for one or more user plane nodes with the "timeSyncCapas" attribute. Within each instance of TimeSyncCapability data structure, the TSCTSF shall include:
        a. the identifier of the applicable NW-TT within the "upNodeId" attribute;
        b. the "gmCapables" attribute indicating if the user plane node supports acting as a gPTP and/or PTP grandmaster;
        c. the supported 5G clock quality within the "asTimeRes" attribute, if applicable; and
        d. the PTP capabilities for each UE within the "ptpCapForUes" attribute, when the Ues are identified with a SUPI, or within "ptpCapForGpsis" attribute, when the Ues are identified with a GPSI.

Upon the reception of an HTTP POST, the NF service consumer shall send an HTTP "204 No Content" response for a successful processing.

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.1.7.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.2.2.5 Ntsctsf_TimeSynchronization_ConfigCreate

5.2.2.5.1 General

This service operation is used by an NF service consumer to create a time synchronization configuration and activate the time synchronization service with the configuration.

The following procedures using the Ntsctsf_TimeSynchronization_ConfigCreate service operation are supported:

- creating a new configuration; and
- creating a subscription for notification for the changes in the time synchronization service configuration.

5.2.2.5.2 Creating a new configuration

Figure 5.2.2.5.2-1 illustrates the creation of a configuration.

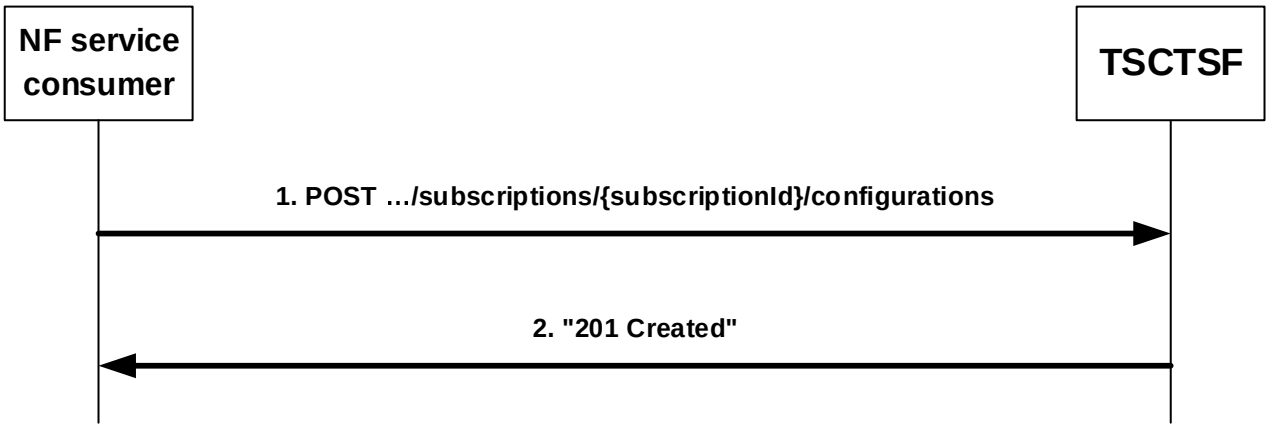

Figure 5.2.2.5.2-1: Creation of a configuration

To create a configuration, the NF service consumer shall send an HTTP POST message to the TSCTSF to the URI "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations". The HTTP POST message shall include the TimeSyncExposureConfig data structure as request body, as shown in figure 5.2.2.5.2-1, step 1. The TimeSyncExposureConfig data structure shall include:

- the user plane node Id within the "upNodeId" attribute;
- the requested PTP instance within the "reqPtpIns" attribute. If the feature "TimeSyncExposureConfig_Corr" is not supported, the (g)PTP ports of the PTP Instance shall be identified only with the GPSI included in the "gpsi" attribute, and, if the feature "TimeSyncExposureConfig_Corr" is supported, (g)PTP ports of the PTP Instance may be identified either by the GPSI included within the "gpsi" attribute or by the SUPI included in the "supi" attribute;
- the time domain within the "timeDom" attribute;
- the notification URI within the "configNotifUri" attribute;
- the notification correlation Id within the "configNotifId" attribute;

and may include:

- the "gmEnable" attribute set to true if the AF requests 5GS to act as a grandmaster for PTP or gPTP;
- the time synchronization error budget within the "timeSyncErrBdgt" attribute;
- the gandmaster priority with the "gmPrio" attribute;
- the temporal validity condition within the "tempValidity" attribute;

- if the "CoverageAreaSupport" feature is supported, the time synchronization coverage area encoded as "covReq" attribute, that contains a list of Tracking Area codes per serving network where the requested PTP instance applies; and

- if the "NetTimeSyncStatus" feature is supported, the clock quality detail level in the "clkQltDetLvl" attribute and the clock quality acceptance criteria for the PTP instance in the "clkQltAcptCri" attribute if applicable, if the NF service consumer subscribes to receiving network time synchronization status report(s).

NOTE 1: The AF request for PTP service activation, modification cannot indicate that the clock quality detail level to provide is "metrics", i.e. if the AF includes the clock quality detail level, its value needs to set to "acceptable/not acceptable indication" and accompanied with "clock quality acceptance criteria". The UE/DS-TT retrieves detailed information (timing synchronization metrics) from Announce messages sent for (g)PTP services.

Upon receipt of the HTTP request from the NF service consumer, if the request is authorized, the TSCTSF shall:

- create a new resource, which represents a new "Individual Time Synchronization Exposure Configuration" instance, addressed by a URI as defined in clause 6.1.3.5 and containing a TSCTSF created resource identifier;

- send an HTTP "201 Created" response with TimeSyncExposureConfig data structure as response body and a Location header field containing the URI of the created Individual Time Synchronization Exposure Configuration resource, i.e. "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subcriptionId}/configuration/{configurationId}", as shown in figure 5.2.2.5.2-1, step 2;

- use the {subscriptionId} within the requested URI and user plane node ID within the "upNodeId" attribute in the request to determine the target UEs and corresponding authorized AF sessions, then use the parameters (e.g. requested PTP instance type, transport protocol, and PTP profile) in the request to determine suitable DS-TT(s) and AF session(s) among all the AF session(s) and:

  a. if the "CoverageAreaSupport" feature is supported and a time synchronization coverage area is provided within the "covReq" attribute, the TSCTSF perform the following operations:

     1. If the UE's Time Synchronization Subscription data from the UDM contains the list of TA(s) that comprise the authorized time synchronization coverage area, if the requested time synchronization coverage area within the "covReq" attribute is within the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area is fulfilled, and the UE is authorized for the requested time synchronization service. If the Authorized Time Synchronization Coverage Area is inside of the requested Coverage Area, the TSCTSF uses the Authorized Time Synchronization Coverage Area. If the requested Coverage Area partly overlaps with the Authorized Time Synchronization Coverage Area, the TSCTSF uses the intersection of them. If there is no overlap between them, the TSCTSF shall reject the AF request as described in clause 5.27.1.11 of 3GPP TS 23.501 [2].

     2. The TSCTSF discovers the list of AMF(s) serving the list of TA(s) that comprise the authorized time synchronization coverage area using the Nnrf_NFDiscovery service operation as described in 3GPP TS 29.510 [10], if they are not available, and, for each UE with matched AF-sessions, subscribes with the discovered AMF(s) to receive notifications about presence of the UE in an Area of Interest events using the Namf_EventExposure service as described in 3GPP TS 29.518 [27], where the Area of Interest is the provided time synchronization coverage area.

     3. Based on the outcome provided by the AMF about the UE’s presence in the Area of Interest and the authorized time synchronization coverage area, the TSCTSF determines if the time synchronization service is activated or deactivated:

        i. If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is fulfilled, and the UE is authorized for the activation of the received PTP instance configuration.

        ii. If the UE presence is not within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is not fulfilled, and the UE is not authorized for the activation of the received PTP instance configuration;

  b If the UE's Time Synchronization Subscription data contains the authorized Uu time synchronization error budget, and the requested time synchronization error budget within the "timeSyncErrBdgt" attribute is within

the authorized time synchronization Uu time synchronization error budget, the TSCTSF determines that the UE(s) are authorized for the requested time synchronization service.

c. If the UE's Time Synchronization Subscription data contains the periods of authorized start and stop times, and the requested temporal validity condition within the "tempValidity" attribute is within any of the periods of authorized start and stop times, the TSCTSF determines that the UE is authorized for the requested time synchronization service.

d. If the UE's Time Synchronization Subscription data contains the clock quality detail level and the clock quality acceptance criteria and if the "NetTimeSyncStatus" feature is supported and the requested clock quality detail level within the "clkQltDetLvl" attribute and optionally the clock quality acceptance criteria in the "clkQltAcptCri" attribute are within the authorized clock quality detail level and the clock quality acceptance criteria, the TSCTSF determines that the UE is authorized for the requested time synchronization service.

NOTE 2: Each parameter in the AF requested clock quality information is evaluated individually, if the TSCTSF determines that at least one parameter within the "ACCEPT_INDICATION" attribute is “not acceptable”, the TSCTSF shall reject the AF request as described in clause 5.27.1.11 of 3GPP TS 23.501 [2].

- create a new resource, which represents a new "Individual Time Synchronization Exposure Configuration" instance, addressed by a URI as defined in clause 6.1.3.5 and containing a TSCTSF created resource identifier;

- send an HTTP "201 Created" response with TimeSyncExposureConfig data structure as response body and a Location header field containing the URI of the created Individual Time Synchronization Exposure Configuration resource, i.e. "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subcriptionId}/configuration/{configurationId}", as shown in figure 5.2.2.5.2-1, step 2;

- for each authorized UE and matched AF-session, contact with the each corresponding PCF for the PDU session to configure and initialize the PTP instance in the DS-TT(s) and NW-TT as defined in 3GPP TS 23.502 [3], clause 4.15.9.3.2, step 5-6;

- for each authorized UE and matched AF-session(s), calculate the Uu time synchronization error budget as specified in clauses 5.27.1.9 and 5.27.1.11 of 3GPP TS 23.501 [2], subscribe to event notifications of newly registered PCF for the UE for the affected Ues by invoking Nbsf_Management_Subscribe Service Operation as defined in clause 4.2.6 of 3GPP TS 29.521 [23] if not yet done, and send a request to the PCF for the UE for AM policy authorization by invoking Npcf_AMPolicyAuthorization_Create service operation as defined in clause 4.2.2 of 3GPP TS 29.534 [14] providing the appropriate values in the "asTimeDisParam" attribute in order to activate the access stratum time distribution and provide the calculated Uu time synchronization error budget.

- if the "NetTimeSyncStatus" feature is supported and each parameter of the clock quality acceptance criteria provided in the "clkQltAcptCri" attribute is within the each parameter of the authorized clock quality acceptance criteria in the UE's Time Synchronization Subscription data, then the TSCTSF:

  1. subscribe to UPF/NW-TT time synchronization status reports via UMIC as described in clause 4.2.2.31 of 3GPP TS 29.514 [20], if the UPF/NW-TT is involved in providing time synchronization information to DS-TT; and

  2. in case NG-RAN is involved in providing time synchronization status information to DS-TT, send the time synchronization status reporting control information to the NG-RAN and then initiate the subscription to the NG-RAN time synchronization status via AMF, if not previously done for the involved NG-RAN node, as described in 3GPP TS 29.518 [27].

If the authorized temporal validity condition is provided and if the start-time is in the future, the TSCTSF shall maintain the time synchronization configuration and then proceed as described above when the start-time is reached; otherwise, if the start-time is in the past, the TSCTSF shall proceed as described above immediately. When the stop-time is reached for active time synchronization service configuration, the TSCTSF shall proceed as Ntsctsf_TimeSynchronization_ConfigDelete was received as described in clause 5.2.2.7.2 without interacting with the AF.

The TSCTSF shall associate the affected UEs and matched AF sessions to the "Individual Time Synchronization Exposure Configuration". When the "CoverageAreaSupport" feature is supported, the TSCTSF also associates whether the UE fulfills the authorized time synchronization coverage area condition, if provided. When receiving the

Npcf_PolicyAuthorization_Notify service operation indicating the termination of an existing PDU session and the corresponding AF session is associated with the "Individual Time Synchronization Exposure Configuration" resource, the TSCTSF shall remove the AF session from the list of AF sessions associated with the "Individual Time Synchronization Exposure Configuration" resource and invoke Npcf_AMPolicyAuthorization_Delete service operation as defined in clause 4.2.4 of 3GPP TS 29.534 [14] to remove the access stratum time distribution parameters for the UE if they were provided.

If the AF request is not authorized and/or the feature "SupportReport" is supported and for the requested UE(s) the AF provided parameters are not allowed by subscription, the TSCTSF shall reject the NF service consumer request and indicate in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE_SERVICE_NOT_AUTHORIZED".

If the HTTP POST request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP POST request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.2.2.6 Ntsctsf_TimeSynchronization_ConfigUpdate

5.2.2.6.1 General

This service operation is used by an NF service consumer to update a time synchronization configuration.

The following procedures using the Ntsctsf_TimeSynchronization_ConfigUpdate service operation are supported:

- Updating an existing configuration;
- Creating the subscription for notification for the changes in the time synchronization service configuration in case the subscription was not created before.

5.2.2.6.2 Updating an existing configuration

Figure 5.2.2.6.2-1 illustrates the updating of an existing configuration.

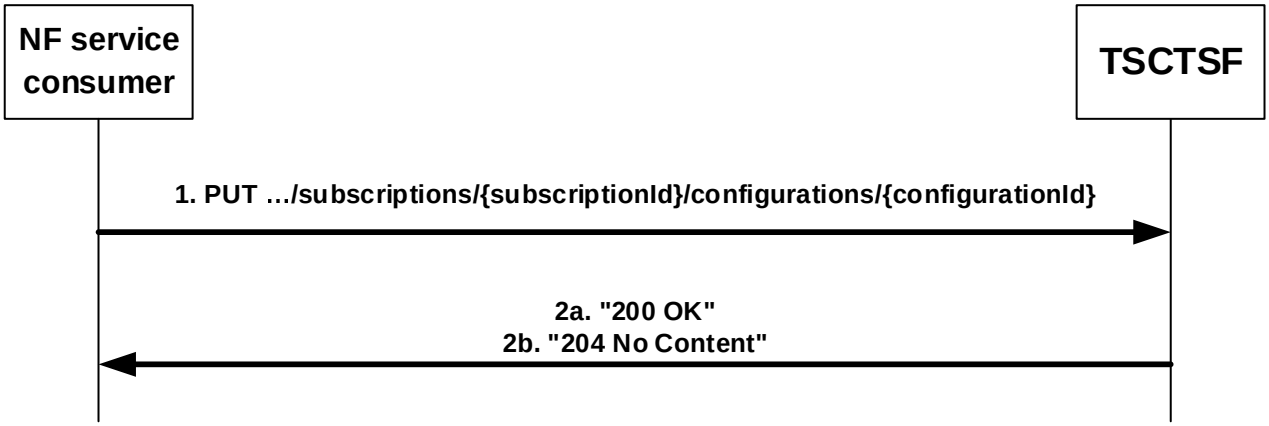

Figure 5.2.2.6.2-1: Update of a configuration

To update a configuration, the NF service consumer shall send an HTTP PUT request to the resource "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations/{configurationId}" representing an existing "Individual Time Synchronization Exposure Configuration" resource, as shown in figure 5.2.2.6.2-1, step 1, to modify the configuration.

The TimeSyncExposureConfig data structure provided in the request body shall include:

- the user plane node Id within the "upNodeId" attribute;

NOTE 1: The user plane node Id cannot be changed during the modification.

- the requested PTP instance within the "reqPtpIns" attribute. If the feature "TimeSyncExposureConfig_Corr" is not supported, the (g)PTP ports of the PTP Instance shall be identified only with the GPSI included in the "gpsi" attribute, and, if the feature "TimeSyncExposureConfig_Corr" is supported, (g)PTP ports of the PTP Instance may be identified either by the GPSI included within the "gpsi" attribute or by the SUPI included in the "supi" attribute;

- the time domain within the "timeDom" attribute;

NOTE 2: The user plane node Id, the requested PTP instance and the time domain cannot be changed during the modification.

- the notification URI within the "configNotifUri" attribute;

- the notification correlation Id within the "configNotifId" attribute;

NOTE 3: If the notification URI or notification correlation Id is not changed the previously value is included.

and may include:

- the "gmEnable" attribute set to true if the AF requests 5GS to act as a grandmaster for PTP or gPTP;

- the time synchronization error budget within the "timeSyncErrBdgt" attribute;

- the gandmaster priority with the "gmPrio" attribute;

- the temporal validity condition within the "tempValidity" attribute;

- if the "CoverageAreaSupport" feature is supported, the spatial validity condition encoded as "covReq" attribute, that contains a list of Tracking Area codes per serving network where the requested PTP instance applies; and

- if the "NetTimeSyncStatus" feature is supported, the clock quality detail level in the "clkQltDetLvl" attribute and the clock quality acceptance criteria for the PTP instance in the "clkQltAcptCri" attribute if applicable.

Upon receipt of the corresponding HTTP PUT message, if the request is authorized, theTSCTSF shall:

- update the existing "Individual Time Synchronization Exposure Configuration" resource;

- send a HTTP response including "200 OK" status code with TimeSyncExposureConfig data structure or "204 No Content" status code, as shown in figure 5.2.2.6.2-1, step 2;

- use the {subscriptionId} within the requested URI and user plane node ID within the "upNodeId" attribute in the request to determine the target UEs and corresponding AF-sessions, then use the updated parameters (e.g. requested PTP instance type, transport protocol, and PTP profile) in the request to determine suitable DS-TT(s) and AF session(s) among all AF session:

    a. If the "CoverageAreaSupport" feature is supported and a requested coveragea area is provided or updated within the "covReq" attribute, the TSCTSF perform the following operations:

        1. the TSCTSF, based on the time synchronization coverage area retrieved from UDM determines whether the UE is authorized for the request again as described in clause 5.2.2.5.2.

        2. The TSCTSF discovers the list of AMF(s) serving the list of TA(s) that comprise the authorized time synchronization coverage area using the Nnrf_NFDiscovery service operation as described in 3GPP TS 29.510 [10], if they are not available, and for each UE with matched AF-sessions, subscribes/updates the subscription, if applicable, with the discovered AMF(s) to receive notifications about presence of the UE in an Area of Interest events using the Namf_EventExposure service as described in 3GPP TS 29.518 [27], where the Area of Interest is the requested/applicable spatial validity condition.

        3. Based on the outcome provided by the AMF or available in the TSCTSF about the UE’s presence in the Area of Interest, the TSCTSF determines if the time synchronization service is activated or deactivated:

            i. If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the spatial validity condition is fulfilled, and the UE is authorized for the activation of the received PTP instance configuration.

- If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the spatial validity condition is not fulfilled, and the UE is not authorized for the activation of the received PTP instance configuration;

b. If the "CoverageAreaSupport" feature is supported and a requested coverage area previously provided is removed, the TSCTSF perform the following operations:

1. For each UE with matched AF-sessions, the TSCTSF terminates the subscriptions to notifications about presence of the UE in an Area of Interest events using the Namf_EventExposure service as described in 3GPP TS 29.518 [27].

2. For each UE with matched AF-sessions that did not fulfil the removed spatial validity condition, the TSCTSF determines the UE is authorized for the activation of the received PTP instance configuration

c. If the time synchronization error budget within the "timeSyncErrBdgt" attribute, the temporal validity condition within the "tempValidity" attribute, and/or, if the "NetTimeSyncStatus" feature is supported the requested clock quality detail level within the "clkQltDetLvl" attribute and optionally the clock quality acceptance criteria in the "clkQltAcptCri" attribute from the NF service consumer are provided, updated, or removed, the TSCTSF based on the Time Synchronization Subscription data retrieved from the UDM determines whether the UE is authorized for the request again as described in clause 5.2.2.5.2.

- update the existing "Individual Time Synchronization Exposure Configuration" resource;

- send a HTTP response including "200 OK" status code with TimeSyncExposureConfig data structure or "204 No Content" status code, as shown in figure 5.2.2.6.2-1, step 2;

- for each authorized UE and matched AF-session, and contact with each correspondingPCF for the PDU session to configure and initialize the PTP instance in the DS-TT(s) and NW-TT as defined in 3GPP TS 23.502 [3], clause 4.15.9.3.3, step 5-6. The TSCTSF associates the new affected AF session(s) with the "Individual Time Synchronization Exposure Configuration" resource.

- for each authorized UE with matched AF-session(s), if the time synchronization error budget is provided, updated, or removed, calculate the Uu time synchronization error budget as specified in clause 5.27.1.9 of 3GPP TS 23.501 [2]and send a request to the PCF for the UE for AM policy authorization by invoking Npcf_AMPolicyAuthorization_Update service operation as defined in clause 4.2.3 of 3GPP TS 29.534 [14] in order to update the Uu time synchronization error budget.

- if the "NetTimeSyncStatus" feature is supported and the updated clock quality acceptance criteria is provided within the "clkQltAcptCri" attribute, then the TSCTSF if the updated clock quality acceptance criteria is within the authorized clock quality acceptance criteria in the UE's Time Synchronization Subscription data, and the clock acceptance criteria results is not available, then TSCTSF shall:

1. subscribe to UPF/NW-TT time synchronization status reports via UMIC as described in clause 4.2.3.34 of 3GPP TS 29.514 [20], if the UPF/NW-TT is involved in provoding time information to DS-TT; and

2. in case NG-RAN is involved in providing time synchronization status information to DS-TT, then TSCTSF sends the updated configuration of time synchronization status reporting to the NG-RAN and then initiates the subscription to the NG-RAN time synchronization status via, as described in 3GPP TS 29.518 [27]

If the temporal validity condition was provided but it is removed during the update of time synchronization configuration, the TSCTSF shall perform the time synchronization configuration as described above without considering the temporal validity condition.

If the temporal validity condition was not provided and the temporal validity condition is provided during the update of configuration, the TSCTSF shall perform as follows:

- if the authorized start-time is in the future, the TSCTSF shall maintain the authorized time synchronization configuration and then proceeds as described above when the authorized start-time is reached; otherwise, if the authorized start-time is in the past, the TSCTSF shall proceed as described above immediately; and

- if the authorized stop-time is reached for active time synchronization service configuration, the TSCTSF shall proceed as Ntsctsf_TimeSynchronization_ConfigDelete was received as described in clause 5.2.2.7.2 without interacting with the AF.

If the temporal validity condition was provided and the temporal validity condition is updated during the update of configuration, the TSCTSF shall perform as follows:

- if the previously provided authorized time configuration is being applied but the new start-time is in the future, the TSCTSF shall proceed as Ntsctsf_TimeSynchronization_ConfigDelete was received as described in clause 5.2.2.7.2 without interacting with the AF firstly and then proceeds as described above when the new start-time is reached; otherwise if the time synchronization configuration has been created but the newstart-time is in the past, the TSCTSF keep the existing configuration;

- when the new stop-time is reached for active time synchronization service configuration, the TSCTSF shall proceed as Ntsctsf_TimeSynchronization_ConfigDelete was received as described in clause 5.2.2.7.2 without interacting with the AF; and

- if the previously provided time configuration is not being applied because the previously provided authorized start-time is in the future, the TSCTSF shall perform as the case that the temporal validity condition was not provided previously.

The TSCTSF shall associate the affected UEs and matched AF session to the "Individual Time Synchronization Exposure Configuration". When the "CoverageAreaSupport" feature is supported, the TSCTSF also associates whether the UE fulfills the spatial validity condition, if provided. When receiving the Npcf_PolicyAuthorization_Notify service operation indicating the termination of an existing PDU session and the corresponding AF session is associated with the "Individual Time Synchronization Exposure Configuration" resource, the TSCTSF shall remove the AF session from the list of AF sessions associated with the "Individual Time Synchronization Exposure Configuration" resource and invoke Npcf_AMPolicyAuthorization_Delete service operation as defined in clause 4.2.4 of 3GPP TS 29.534 [14] to remove the access stratum time distribution parameters for the UE if they were provided.

If the AF request is not authorized and/or the feature "SupportReport" is supported and for the requested UEs one or more of the AF provided parameters are not allowed by subscription, the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE_SERVICE_NOT_AUTHORIZED".

If the HTTP PUT request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP PUT request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP PUT request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.2.2.7 Ntsctsf_TimeSynchronization_ConfigDelete

5.2.2.7.1 General

This service operation is used by an NF service consumer to delete a time synchronization configuration.

The following procedures using the Ntsctsf_TimeSynchronization_ConfigDelete service operation are supported:

- Deleting an existing configuration.

5.2.2.7.2 Deleting an existing configuration

Figure 5.2.2.7.2-1 illustrates the deleting of an existing configuration.

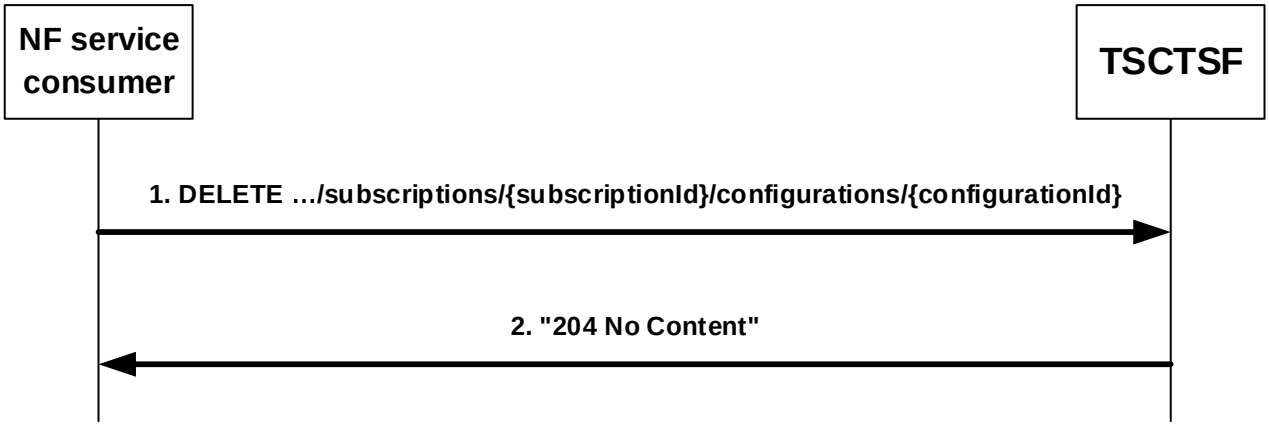

Figure 5.2.2.7.2-1: Deletion of a configuration

To delete a configuration, the NF service consumer shall send an HTTP DELETE request to the resource "{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations/{configurationId}" representing an existing "Individual Time Synchronization Exposure Configuration" resource, as shown in figure 5.2.2.7.2-1, step 1, to delete the configuration.

Upon the reception of an HTTP DELETE request and if the HTTP DELETE request is accepted by the TSCTSF, the TSCTSF shall:

- remove the corresponding configuration and respond with "204 No Content" as shown in figure 5.2.2.7.2-1, step 2;
- use the {configurationId} within the requested URI to identify the time synchronization service configuration and the corresponding AF sessions, and then interact with:
  - the PCF(s) for the PDU Session to disable the corresponding PTP instance(s) in the DS-TT(s) and NW-TT as defined in 3GPP TS 23.502 [3], clause 4.15.9.3.4, step 5-6.
  - the PCF(s) for the UE to remove the time synchronization error budget by invoking the Npcf_AMPolicyAuthorization_Delete service operation as defined in clause 4.2.4 of 3GPP TS 29.534 [14].

If the HTTP DELETE request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP DELETE request the cause for the rejection as specified in clause 6.1.7.

If the TSCTSF determines the received HTTP DELETE request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.2.2.8 Ntsctsf_TimeSynchronization_ConfigUpdateNotify

5.2.2.8.1 General

This service operation is used by an TSCTSF to notify the NF Service Consumer of the current state of the time synchronization configuration.

The following procedures using the Ntsctsf_TimeSynchronization_ConfigUpdateNotify service operation are supported:

- notification about the current state of the time synchronization configuration.

5.2.2.8.2 Notifying the current state of an existing configuration

Figure 5.2.2.8.2-1 illustrates the notification about the current state of the time synchronization configuration.

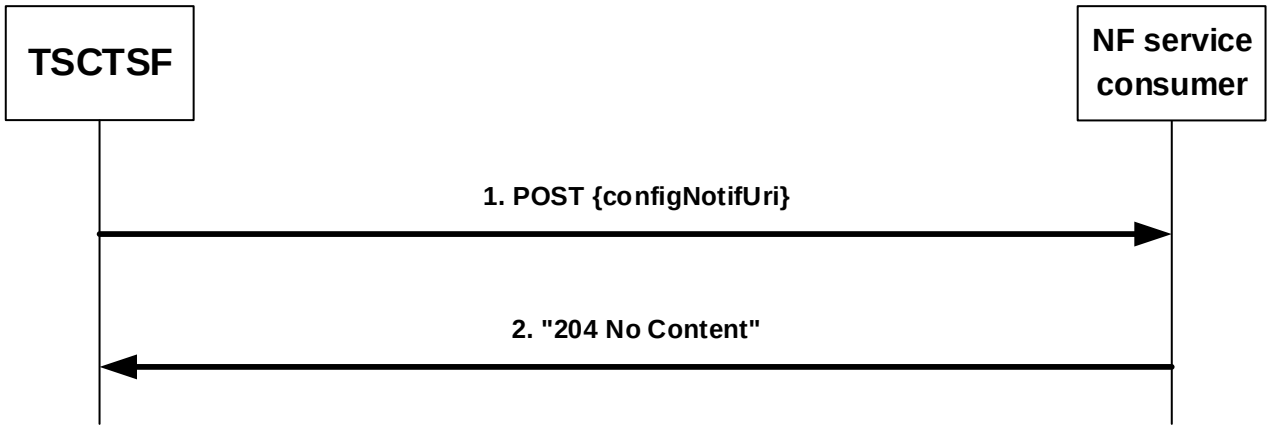

Figure 5.2.2.8.2-1: Notification about the current state of the time synchronization configuration

When the TSCTSF determines that the modification of the configuration of the PTP instance(s) in a DS-TT and/or NW-TT, the TSCTSF receives the notification of the change in the PTP instance for each DS-TT and/or NW-TT from the PCF as defined in clause 4.2.5.13 of 3GPP TS 29.514 [20] or the TSCTSF receives the NG-RAN time synchronization status update related to clock quality acceptance criteria via AMF as described in clause 5.2.2.4.2 of 3GPP TS 29.518 [27] and determines the affected PTP instance(s), the TSCTSF shall send an HTTP POST request with "{configNotifUri}", as previously provided by the NF service consumer within the corresponding configuration, as URI and the TimeSyncExposureConfigNotif data structure as request body, as shown in figure 5.2.2.8.2-1, step 1.

The TimeSyncExposureConfigNotif data structure as request body that shall include:

- Notification correlation ID provided by the NF service consumer during the configuration within the "configNotifId" attribute;
- current states of the time synchronization configuration for the DS-TT port(s) and/or NW-TT port within the "stateOfConfig" attribute;

and may include:

- if "NetTimeSyncStatus" feature is supported, the report of whether the time synchronization service status according to the clock quality acceptance criteria result is acceptable or not acceptable within the "stateOfConfig" attribute.

If the "CoverageAreaSupport" feature is supported and the TSCTSF received time synchronization coverage area as part of the Ntsctsf_TimeSynchronization_ConfigCreate/Update service operation as described in clauses 5.2.2.5.2 and 5.2.2.6.2, when the TSCTSF receives a change in the UE presence in Area of Interest notification as described in 3GPP TS 29.518 [27], the TSCTSF checks the activation or deactivation of the time synchronization service and adds/removes the UE/DS-TT port to/from the PTP instance and configures the Grandmaster functionality, as applicable, as specified in clause K.2.1 of 3GPP TS 23.501 [2]. For the added/removed UE/DS-TT port to/from the PTP instance, the TSCTSF triggers the notification to the NF service consumer where the "stateOfDstts" attribute within the "stateOfConfig" attribute shall include the state of the added/removed UE/DS-TT port.

If the "NetTimeSyncStatus" feature is supported and the TSCTSF received the clock quality detail level and the clock quality acceptance criteria as part of the Ntsctsf_TimeSynchronization_ConfigCreate/Update service operation as described in clauses 5.2.2.5.2 and 5.2.2.6.2, when the TSCTSF receives a change corresponding to the time synchronization status as described in clause 5.27.1.12 of 3GPP TS 23.501 [2], the TSCTSF provides the notification for the clock quality acceptance criteria result by including the "clkQltIndOfNwtt" attribute within the "stateOfConfig" attribute (for the result related to the UPF/NW-TT to where the UE/DS-TT(s) are connected to) and/or the "clkQltIndOfDstt" attribute within the entries of the "stateOfDstts" attribute of the "stateOfConfig" attribute (for the results related to every DS-TT port).

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.1.7.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.3 Ntsctsf_QoSandTSCAssistance Service

5.3.1 Service Description

5.3.1.1 Overview

This service provides:

- Authorization of NF Service Consumer requests for the resource reservation for TSC.
- NF Service Consumer request to reserve or update resources for handling traffic characterized by TSC QoS parameters as described in clause 6.1.3.22 of TS 23.503 [19].

5.3.1.2 Network Functions

5.3.1.2.1 TSCTSF

The TSCTSF supports to:

- receive the request to reserve or update a specific QoS or a specific QoS with additional Alternative QoS for an AF session;
- receive the request to delete the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements
- receive the request to subscribe or unsubscribe to the event(s) about the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements;
- determine the requested PDB and construct the TSC Assistance Container; and
- Notify the NF service consumer of the event(s).

5.3.1.2.2 NF Service Consumers.

The NF service consumer supports to:

- send the request to reserve or update a specific QoS or a specific QoS with additional Alternative QoS for an AF session;
- send the request to delete the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements
- send the request to subscribe or unsubscribe to the event(s); and
- receive the notification of the event(s).

5.3.2 Service Operations

5.3.2.1 Introduction

Service operations defined for the Ntsctsf_QoSandTSCAssistance service are shown in table 5.3.2.1-1.

Table 5.3.2.1-1: Ntsctsf_TimeSynchronization Service Operations

Service Operation Name	Description	Initiated by
Ntsctsf_QoSandTSCAssistance_Create	Allows the NF service consumer to request the network to provide a specific QoS or a specific QoS with additional Alternative QoS for an AF session.	NF service consumer (e.g. AF, NEF)
Ntsctsf_QoSandTSCAssistance_Update	Allows the NF service consumer to request the network to update the QoS or the QoS with additional Alternative QoS for an AF session	NF service consumer (e.g. AF, NEF)
Ntsctsf_QoSandTSCAssistance_Delete	Allows the NF service consumer to request the network to delete the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements.	NF service consumer (e.g. AF, NEF)
Ntsctsf_QoSandTSCAssistance_Notify	Allows the TSCTSF to report the QoS Flow level event(s) to the NF service consumer.	TSCTSF
Ntsctsf_QoSandTSCAssistance_Subscribe	Allows the NF service consumer to subscribe to the event(s).	NF service consumer (e.g. AF, NEF)
Ntsctsf_QoSandTSCAssistance_Unsubscribe	Allows the NF service consumer to unsubscribe to the event(s).	NF service consumer (e.g. AF, NEF)

NOTE: The NEF and the AF use the Ntsctsf_QoSandTSCAssistance service in the same way.

5.3.2.2 Ntsctsf_QoSandTSCAssistance_Create

5.3.2.2.1 General

This service operation is used by an NF service consumer to request the network to provide a specific QoS for an AF session.

The following procedures using the Ntsctsf_QoSandTSCAssistance_Create service operation are supported:

- Initial provisioning of TSC related service information.
- Subscriptions to Service Data Flow QoS notification control.
- Subscription to Service Data Flow Deactivation
- Subscription to resources allocation outcome
- Subscriptions to Service Data Flow QoS Monitoring Information.
- Initial provisioning of sponsored connectivity information.
- Initial provisioning of AF requested QoS for a UE or a group of UE(s) not identified by UE address(es).
- Subscription to BAT offset notification.

5.3.2.2.2 Initial provisioning of TSC related service information

This procedure is used to set up a TSC AF application session context for the service as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.2.2-1 illustrates the initial provisioning of TSC related service information.

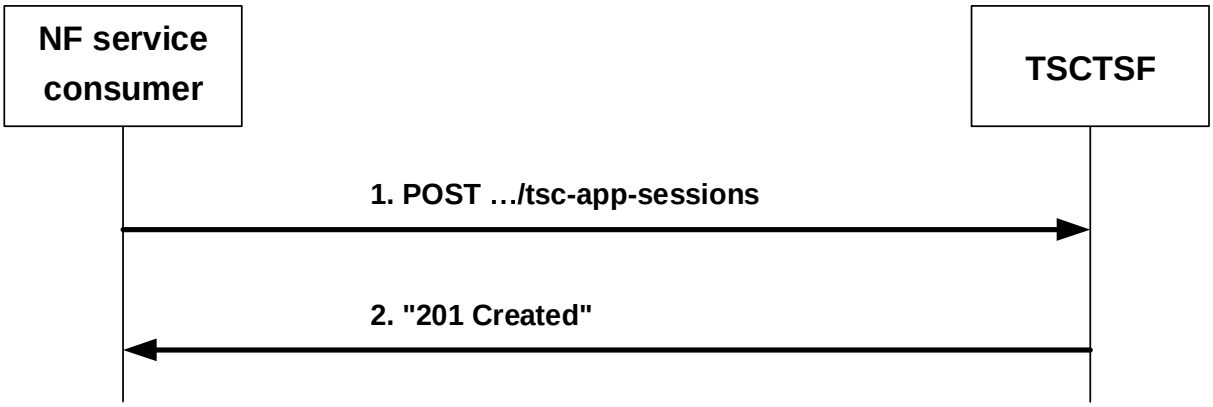

Figure 5.3.2.2.2-1: Initial provisioning of TSC related service information

When a new TSC AF application session context needs to be established, the NF service consumer shall invoke the Ntsctsf_QoSandTSCAssistance_Create service operation by sending the HTTP POST request to the resource URI representing the "TSC Application Sessions" collection resource of the TSCTSF, as shown in figure 5.3.2.2.2-1, step 1.

The NF service consumer shall include the "TscAppSessionContextData" data type in the content of the HTTP POST request in order to request the creation of the "Individual TSC Application Session Context" resource. The "Individual TSC Application Session Context" resource and the "Events Subscription" sub-resource are created as described below.

The NF service consumer shall include in the "TscAppSessionContextData" data structure:

- the AF identifier within the "afId" attribute;
- when the "GMEC" feature is not supported, either:
  - the IP address (IPv4 or IPv6) of the PDU session within the "ueIpAddr" attribute, for IP type PDU sessions; or
  - the MAC address of the DS-TT port within the "ueMac" attribute, for Ethernet type PDU sessions;
- when the "GMEC" feature is supported and as defined in clause 5.3.2.2.8, either:
  - the targeted UE within the "ueId" attribute; or
  - the targeted group of UE(s) within the "externalGroupId" attribute;
- either the Application Id within the "appId" attribute or the flow information within:

  a. for IP flows, the "flowInfo" attribute; or

  b. for Ethernet flows, either the "ethFlowInfo" attribute or, if the Ethernet_UL/DL_Flows feature is supported, the "enEthFlowInfo" attribute;
- the QoS reference within the "qosReference" attribute or the individual QoS parameter set (i.e. requested GBR, requested MBR, requested maximum burst size, requested priority if received and requested 5GS delay if received, and requested packet error rate if received) within the "tscQosReq" attribute. If the individual QoS parameter set within the "tscQosReq" attribute is provided, then the QoS reference within the "qosReference" attribute shall be ignored;
- the input information to construct the TSC Assistance Container within the "tscaiInputUl" attribute and/or "tscaiInputDl" attribute of the "tscQosReq" attribute and the (g)PTP domain that the AF is located in within the "tscaiTimeDom" attribute of the "tscQosReq" attribute, if available; and
- the URI where the TSCTSF can request to the NF service consumer to delete the "Individual TSC Application Session Context" resource within the "notifUri" attribute;

and may include:

- the DNN within the "dnn" attribute;
- the S-NSSAI within the "snssai" attribute;
- the domain identity in the "ipDomain" attribute;
- the individual QoS parameter set within the "tscQosReq" attribute;
- if the "EnTSCAC" feature is supported, the capability for BAT adaptation in the "capBatAdaptation" attribute;
- an ordered list of alternative QoS references within the "altQosReferences" attribute if the QoS reference is provided or an ordered list of requested alternative QoS parameters set(s) within the "altQosReqs" attribute if the individual QoS parameter set is provided. When the NF service consumer provides the "altQosReferences" attribute or the "altQosReqs" attribute, the NF service consumer shall also subscribe to receive notifications from the TSCTSF when the resources associated to the corresponding service information have been allocated as described in clause 5.3.2.2.5 and when the GBR QoS targets for one or more service data flows can no longer (or can again) be guaranteed, as described in clause 5.3.2.2.3;

and

- the request of the notification of certain user plane events within the "evSubsc" attribute. Within the EventsSubscReqData data structure, the NF service consumer shall include:

  a) the URI where the TSCTSF sends the event notification to the NF service consumer within the "notifUri" attribute;

  b) a Notification Correlation Identifier for the requested notifications within the "notifCorreId" attribute;

  c) the subscribed events within the "events" attribute;

  d) the usage threshold within the "usgThres" attribute if the "USAGE_REPORT" event is subscribed; and

  e) QoS monitoring information within the "qosMon" attribute if the "QOS_MONITORING" event is subscribed.

Upon the reception of this HTTP POST request, the TSCTSF shall:

- construct the TSC Assistance Container based on information provided by the NF service consumer;
- if the Requested 5GS delay including the requested 5GS delay within the individual QoS parameter set or within the requested alternative QoS parameters set(s) is received from NF service consumer, calculate a Requested PDB by subtracting the UE-DS-TT residence time either provided by the PCF or pre-configured at TSCTSF from the Requested 5GS delay;
- if the time domain information is not received with the Burst Arrival Time or Periodicity within the "tscQosReq" attribute from the NF service consumer, the TSCTSF may indicate Time Domain = "5GS" within the "tscaiTimeDom" attribute within the "tscQosReq" attribute to indicate that the NF service consumer does not provide the time domain information;

NOTE 2: The Time Domain value corresponding to "5GS" is locally configured in the SMF and in the TSCTSF, and indicates that the AF does not provide a Time Domain and the provided TSCAI input information will be used without adjustments.

- if the feature EnTSCAC is supported and if the NF service consumer includes within the "tscQosReq" attribute the capability for BAT adaptation within the "capBatAdaptation" attribute or the "tscaiInputUl" and/or "tscaiInputDl" attribute(s) with the BAT window within the "burstArrivalTimeWnd" attribute or the periodicity range in the "periodicityRange" attribute , then the TSCTSF shall subscribe to the notification on BAT offset by using the "EventsSubscReqData" data type including an event within the "events" attribute with the "event" attribute set to "BAT_OFFSET_INFO;
- interact with the PCF for the received UE address:

  a) if the TSCTSF has an AF-session with the PCF for the received UE address, the TSCTSF shall interact with the PCF by triggering a Npcf_PolicyAuthorization_Update request to provision the related parameters to the PCF as defined in 3GPP TS 29.514 [20]; or

b) if the TSCTSF does not have an AF-Session with the PCF for the received UE address, the TSCTSF shall discover the PCF for the PDU session as specified in 3GPP TS 29.521 [23], and shall interact with the PCF by triggering a Npcf_PolicyAuthorization_Create to provision the related parameters to the PCF as defined in 3GPP TS 29.514 [20]; and

NOTE 3: If the PCF determines an existing PDU Session is related with TSC traffic (based on local configuration or SM Policy Association), the PCF invokes Npcf_PolicyAuthorization_Notify service operation to the TSCTSF as defined in clause 4.2.5.16 of 3GPP TS 29.514 [20] to send the received TSC User Plane Node information. At that time, the TSCTSF retrieves from the BSF the PCF binding information, as specified in 3GPP TS 29.521 [23], and can create the AF-session by sending to the PCF the Npcf_PolicyAuthorization_Create service operation, if TSC related information, as e.g. QoS requirements, and/or subscription to PMIC(s)/UMIC updates need to be provided to the PCF.

NOTE 4: After the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], the TSCTSF can store internally the received information and delay the Npcf_PolicyAuthorization_Create service operation (the creation of the AF-session). In this case, when the TSCTSF receives the QoS request, the TSCTSF interacts with the PCF by triggering a Npcf_PolicyAuthorization_Create request to provision the related parameters to the PCF as defined in 3GPP TS 29.514 [20].

- if receiving a successful response from the PCF, the TSCSTF shall create an "Individual TSC Application Session Context" resource and send to the NF service consumer a "201 Created" response to the HTTP POST request, as shown in figure 5.3.2.2.2-1, step 2. If the "evSubsc" attribute is received, the "Events Subscription" sub-resource shall be created within the "Individual TSC Application Session Context" resource. The TSCTSF shall include in the "201 Created" response:

  a) a Location header field; and

  b) a "TscAppSessionContextData" data type in the content.

  The Location header field shall contain the URI of the created "Individual TSC Application Session Context" i.e. "{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}".

  When "Events Subscription" sub-resource is created in this procedure, the NF service consumer shall build the sub-resource URI by adding the path segment "/events-subscription" at the end of the URI path received in the Location header field.

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.2.7.

The TSCTSF may send the following error responses based on failed AF-session creation/update request responses received from the PCF as specified in 3GPP TS 29.514 [20]:

a. If the TSCSTSF receives the indication that the PCF failed in executing session binding, the TSCTSF shall reject the HTTP POST request with an HTTP "500 Internal Server Error" response including the "cause" attribute set to "PDU_SESSION_NOT_AVAILABLE".

b. If the service information provided in the body of the HTTP POST request is rejected by the PCF (e.g. the subscribed guaranteed bandwidth for a particular user is exceeded or the authorized data rate in that slice for a UE is exceeded), the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the cause for the rejection including the "cause" attribute set to "REQUESTED_SERVICE_NOT_AUTHORIZED", as received.

c. If the service information provided in the body of the HTTP POST request is rejected due to a temporary condition in the network, the TSCTSF may include in the "403 Forbidden" response the "cause" attribute set to "REQUESTED_SERVICE_TEMPORARILY_NOT_AUTHORIZED". The TSCTSF may also provide a received retry interval within the "Retry-After" HTTP header field. When the NF service consumer receives the retry interval within the "Retry-After" HTTP header field, the NF service consumer shall not send the same service information to the TSCTSF again (for the same application session context) until the retry interval has elapsed. The "Retry-After" HTTP header is described in 3GPP TS 29.500 [4] clause 5.2.2.2.

   The TSCTSF may additionally provide the received acceptable bandwidth within the attribute "acceptableServInfo" included in the "ProblemDetailsTsctsfQosTscac" data structure returned in the rejection response message.

5.3.2.2.3 Subscriptions to Service Data Flow QoS notification control

The NF service consumer shall use the "EventsSubscReqData" data type as described in clause 5.3.2.2.2 and shall include in the HTTP POST request message an event within the "evSubsc" attribute with the "event" attribute set to "QOS_GUARANTEED" and an event within the "evSubsc" attribute with the "event" attribute set to "QOS_NOT_GUARANTEED".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to QoS notification control as described in in 3GPP TS 29.514 [20].

5.3.2.2.4 Subscription to Service Data Flow Deactivation

The NF service consumer shall use the "EventsSubscReqData" data type as described in clause 5.3.2.2.2 and shall include in the HTTP POST request message an event entry within the "evSubsc" attribute with the "event" attribute set to "FAILED_RESOURCES_ALLOCATION".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to service data flow deactivation as described in in 3GPP TS 29.514 [20].

5.3.2.2.5 Subscription to resources allocation outcome

The NF service consumer shall use the "EventsSubscReqData" data type as described in clause 5.3.2.2.2 and shall include in the HTTP POST request message:

- if the NF service consumer requests the TSCTSF to provide a notification when the resources associated to the service information have been allocated, an event entry within the "events" attribute with the "event" attribute set to "SUCCESSFUL_RESOURCES_ALLOCATION"; and/or
- if the NF service consumer requests the TSCTSF to provide a notification when the resources associated to the service information cannot be allocated, an event entry within the "events" attribute with the "event" attribute set to "FAILED_RESOURCES_ALLOCATION".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to notification of resources allocation outcome as described in in 3GPP TS 29.514 [20].

5.3.2.2.6 Subscriptions to Service Data Flow QoS Monitoring Information

The NF service consumer shall use the "EventsSubscReqData" data type as described in clause 5.3.2.2.2 and shall include in the HTTP POST request message an event within the "evSubsc" attribute with the "event" attribute set to "QOS_MONITORING" and include the QoS monitoring information with the "qosMon" attribute. Within the QosMonitoringInformation data structure, the AF shall include:

- one or more requested QoS Monitoring Parameter(s) within the "reqQosMonParams"; and
- one or more report frequency within the "repFreqs" attribute; and
- when the "repFreqs" attribute includes the value "PERIODIC", the periodic time for reporting and, if the feature "PacketDelayFailureReport" is supported, the maximum period with no QoS measurement results reported within the "repPeriod" attribute; and
- when the "repFreqs" attribute includes the value "EVENT_TRIGGERED", the AF shall include:
  - the minimum waiting time between subsequent reports within the "waitTime" attribute; and

  for QoS monitoring for packet delay:

  - the delay threshold for downlink with the "repThreshDl" attribute;
  - the delay threshold for uplink with the "repThreshUl" attribute; and/or

- the delay threshold for round trip with the "repThreshRp" attribute; and
- if the feature "PacketDelayFailureReport" is supported, the maximum period with no QoS measurement results reported within the"repPeriod" attribute.

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to service data flow QoS monitoring information as described in in 3GPP TS 29.514 [20].

5.3.2.2.7 Initial provisioning of sponsored connectivity information

The NF service consumer may include in the HTTP POST request message described in clause 5.3.2.2.2 an application service provider identity and a sponsor identity within the "aspId" attribute and "sponId" attribute. Additionally, the NF service consumer may provide an indication to the TSCTSF of sponsored data connectivity not enabled by including the "sponStatus" attribute set to "SPONSOR_DISABLED".

To support the usage monitoring of sponsored data connectivity, the NF service consumer may subscribe with the TSCTSF to the notification of usage threshold reached. The NF service consumer may also include the "evSubsc" attribute with:

- the usage thresholds to apply in the "usgThres" attribute; and
- an entry of the "events" attribute set to "USAGE_REPORT".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall provision the sponsored data connectivity information to the PCF as described in 3GPP TS 29.514 [20].

The TSCTSF may send the following error responses based on the response to the provisioning of sponsored data connectivity information received from the PCF, as described in 3GPP TS 29.514 [20], as follows:

- HTTP "403 Forbidden" response message with the "cause" attribute set to "UNAUTHORIZED_SPONSORED_DATA_CONNECTIVITY", when received from the PCF.
- HTTP "403 Forbidden" response message the "cause" attribute set to "REQUESTED_SERVICE_NOT_AUTHORIZED", when received from the PCF.

5.3.2.2.8 Initial provisioning of AF requested QoS for a UE or group of UE(s) not identified by UE address(es)

When the "GMEC" feature is supported, if the NF service consumer includes in the HTTP POST request message defined in clause 5.3.2.2.2 the targeted UE identified by its GPSI, within the "ueId" attribute, or the targeted group of UE(s) identified by its External Group ID, within the "externalGroupId" attribute, the provisions of clause 5.3.2.2.2 shall apply with the following differences:

- The AF request may include:
  a. the temporal invalidity conditions, within the "tempInValidity" attribute;
  b. the event(s) subscription, including the QoS monitoring parameters, within the "evSubsc" attribute;
  c. the traffic characteristics and, if applicable, QoS parameters, within the "tscQosReq" attribute;
  d. the QoS parameters, within either the "qosReference" attribute, the "altQosReferences" attribute or the "altQosReqs" attribute; and/or
  e. the flow description, within either the "flowInfo" attribute, the "ethFlowInfo" attribute or the "enEthFlowInfo" attribute.

The TSCTSF shall process the request and reply to the NF service consumer as defined in clause 5.3.2.2.2 with the following differences:

- Upon reception of the HTTP request from the NF service consumer, and if the request is authorized, the TSCTSF shall:

  - create a new "Individual TSC Application Session Context" resource;

  - if the "externalGroupId" attribute is received from the NF service consumer, interact with the UDM to retrieve the list of SUPI(s) identifying the UE(s) constituting the targeted group of UE(s) using the Nudm_SDM service as defined in 3GPP TS 29.503 [24];

  - if the "ueId" attribute is received from the NF service consumer, interact with the UDM to retrieve the SUPI that corresponds to the targeted GPSI using the Nudm_SDM service as defined in 3GPP TS 29.503 [24];

  - use the parameters received from the NF service consumer (i.e., DNN, S-NSSAI, the identifier of the targeted UE or group of UE(s)) to determine the corresponding AF session(s) (i.e., to which they macth); and

  - for each matching AF session, interact with the PCF by invoking the Npcf_PolicyAuthorization_Create/Update service operation, as defined in 3GPP TS 29.514 [20], to create/update the AF session based on the provided requested QoS parameters.

NOTE 1: If the PCF determines that an existing PDU Session is potentially impacted by the time synchronization service (based on local configuration or SM Policy Association), the PCF invokes Npcf_PolicyAuthorization_Notify service operation towards the TSCTSF as defined in clause 4.2.5.16 of 3GPP TS 29.514 [20] to send the received TSC User Plane Node information. The TSCTSF then retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], and can create the AF session by invoking the Npcf_PolicyAuthorization_Create service operation towards the PCF.

- The TSCTSF shall handle the AF session(s) associated with a given "Individual TSC Application Session Context" resource as follows:

  - For the association of the AF session(s) at the PCF to the "Individual TSC Application Session Context" resource:

    a. Upon PDU Session establishment, i.e. when the TSCTSF receives a Npcf_PolicyAuthorization_Notify service operation following the establishment of a new PDU session, the TSCTSF shall retrieve from the BSF, as specified in 3GPP TS 29.521 [23], the PCF binding information to complete the necessary AF session information. The TSCTSF shall then trigger the Npcf_PolicyAuthorization_Create service operation towards the PCF to create an AF session to subscribe to TSC user plane node related event(s). The TSCTSF shall use the parameters of the existing "Individual TSC Application Session Context" resources to determine whether they shall be associated to this newly created AF session. The TSCTSF associates the new AF session to the "Individual TSC Application Session Context" resource to which these parameters match.

    b. Upon "Individual TSC Application Session Context" resource creation, the TSCTSF uses the parameters of the created resource to determine which existing AF session(s) it matches. The TSCTSF then associates the new "Individual TSC Application Session Context" resource to the corresponding AF session(s).

  - To remove an AF session from the list of AF session(s) associated to an "Individual TSC Application Session Context" resource, when the TSCTSF receives the Npcf_PolicyAuthorization_Notify service operation from the PCF indicating the termination of the corresponding existing PDU session, the TSCTSF triggers the Npcf_PolicyAuthorization_Delete service operation towards the PCF and determines if the corresponding AF session is associated with the "Individual TSC Application Session Context" resource. If it is the case, the TSCTSF shall remove the AF session from the list of AF session(s) associated with the "Individual TSC Application Session Context" resource.

NOTE 2: After the TSCTSF retrieves from the BSF the PCF binding information (including the UE Identities for the notified PDU session), as specified in 3GPP TS 29.521 [23], the TSCTSF can store internally the information required to invoke Npcf_PolicyAuthorization_Create service operation and delay the Npcf_PolicyAuthorization_Create service operation (i.e., the creation of the AF session) until a request is received for the concerned UE (e.g., time synchronization capability exposure or QoS provisioning request). In this case, when the TSCTSF receives a request for the concerned UE (e.g., time synchronization capability exposure or QoS provisioning request), the TSCTSF interacts with the PCF by triggering the Npcf_PolicyAuthorization_Create service operation as defined in 3GPP TS 29.514 [20].

NOTE 3: When the TSCTSF receives the Npcf_PolicyAuthorization_Notify service operation indicating the termination of an existing PDU session associated to an AF session that is not associated with any "Individual Time Synchronization Exposure Subscription" resource nor "Individual TSC Application Session Context resource" resource, the TSCTSF removes the AF session and triggers the Npcf_PolicyAuthorization_Delete service operation towards the PCF.

5.3.2.2.9 Subscription to BAT offset notification

When the "EnTSCAC" feature is supported, The NF service consumer shall use the "EventsSubscReqData" data type and shall include in the HTTP POST request message an event entry within the "evSubsc" attribute with the "event" attribute set to "BAT_OFFSET_INFO" to subscribe to receive a notification when AF provides the Capability for BAT adaptation or BAT Window as defined in clause 5.3.2.2.2.

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.2.2.

As result of this action, the TSCTSF shall set the appropriate subscription to BAT offset notification as described in 3GPP TS 29.514 [20].

5.3.2.3 Ntsctsf_QoSandTSCAssistance_Update

5.3.2.3.1 General

This service operation is used by an NF service consumer to request the network to update the QoS and/or additional Alternative QoS for an AF session.

The following procedures using the Ntsctsf_QoSandTSCAssistance_Update service operation are supported:

- Modification of TSC related service information.
- Modification of Subscription to Service Data Flow QoS notification control.
- Modification of Subscription to Service Data Flow Deactivation.
- Modification of subscription to resources allocation outcome.
- Modification of Subscription to Service Data Flow QoS Monitoring Information.
- Modification of sponsored connectivity information.
- Modification of AF the requested QoS for a UE or a group of UE(s) not identified by UE address(es).
- Modification of subscription to BAT offset notification.

5.3.2.3.2 Modification of TSC related service information

This procedure is used to modify an existing TSC application session context as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.3.2-1 illustrates the modification of TSC related service information using HTTP PATCH method.

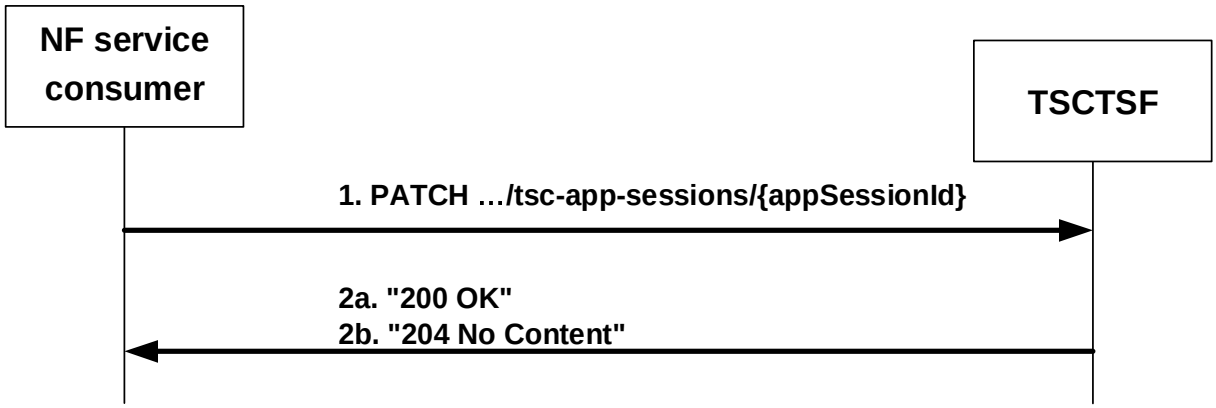

Figure 5.3.2.3.2-1: Modification of TSC related service information using HTTP PATCH

The NF service consumer may modify the TSC application session context information at any time and invoke the Ntsctsf_QoSandTSCAssistance_Update service operation by sending the HTTP PATCH request message to the resource URI representing the "Individual TSC Application Session Context" resource, as shown in figure 5.3.2.3.2-1, step 1, with the modifications to apply.

The JSON body within the PATCH request shall include the "TscAppSessionContextUpdateData" data type and shall be encoded according to "JSON Merge Patch", as defined in IETF RFC 7396 [22].

The NF service consumer may include in the "TscAppSessionContextUpdateData" data structure:

- the updated flow information within the "flowInfo" attribute for IP flows or, either the "ethFlowInfo" or, if the Ethernet_UL/DL_Flows feature is supported, the "enEthFlowInfo" attribute for Ethernet flows;
- the updated application Id within the "appId" attribute;
- the updated QoS reference within the "qosReference" attribute or the updated individual QoS parameter set within the "tscQosReq" attribute;
- the updated input information to construct the TSC Assistance Container within the "tscaiInputUl" attribute and/or "tscaiInputDl" attribute of the "tscQosReq" attribute, and/or the updated (g)PTP domain that the AF is located in within the "tscaiTimeDom" attribute of the "tscQosReq" attribute;
- if the "EnTSCAC" feature is supported, the capability for BAT adaptation in the "capBatAdaptation" attribute;
- the updated URI where the TSCTSF can request to the NF service consumer to delete the "Individual TSC Application Session Context" resource within the "notifUri".
- the updated ordered list of alternative QoS references within the "altQosReferences" attribute or updated ordered list of requested alternative QoS parameters set(s) within the "altQosReqs" attribute; and
- the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data structure, the NF service consumer shall include:
  - the new complete list of subscribed events within the "events" attribute;
  - when the NF service consumer requests to update the additional information related to an event (e.g. the NF service consumer needs to provide new thresholds to the TSCTSF in the "usgThres" attribute related to the "USAGE_REPORT" event), the additional information within the corresponding attribute(s).

NOTE 2: Note that when the NF service consumer requests to remove an event, this event is not included in the "events" attribute.

NOTE 3: When an event is included in the "events" attribute and its related additional information is set to null, the TSCTSF considers the subscription to this event is active, but the related procedures stop applying.

NOTE 4: When an event is removed from the "events" attribute but its related information is not set to null, the TSCTSF considers the subscription to this event is terminated, the related additional information is removed, and the related procedures stop applying.

The NF service consumer shall remove existing event subscription information by setting to null the "evSubsc" attribute included in "TscAppSessionContextUpdateData".

NOTE 5: The "notifUri" attribute within the EventsSubscReqData data structure can be modified to request that subsequent notifications are sent to a new NF service consumer.

Upon the reception of this HTTP PATCH request, the TSCTSF shall

- if the updated Requested 5GS delay including the requested 5GS delay within the individual QoS parameter set or within the requested alternative QoS parameters set(s) is received from NF service consumer, re-calculate a Requested PDB by subtracting the UE-DS-TT residence time provided by the PCF or pre-configured in the TSCTSF from the Requested 5GS delay;

- update the TSC Assistance Container based on updated information provided by the NF service consumer;

- if the time domain information is not received with the Burst Arrival Time or Periodicity within the "tscQosReq" attribute from the NF service consumer, the TSCTSF may indicate Time Domain = "5GS" within the "tscaiTimeDom" attribute within the "tscQosReq" attribute to indicate that the NF service consumer does not provide the time domain information;

NOTE 6: The Time Domain value corresponding to "5GS" is locally configured in the SMF and in the TSCTSF, and indicates that the AF does not provide a Time Domain and the provided TSCAI input information will be used without adjustments.

- if the feature EnTSCAC is supported and if the NF service consumer during the modification includes within the "tscQosReq" attribute the capability for BAT adaptation within the "capBatAdaptation" attribute or the "tscaiInputUl" and/or "tscaiInputDl" attribute(s) with the BAT window within the "burstArrivalTimeWnd" attribute or the periodicity range in the "periodicityRange" attribute, then the TSCTSF shall subscribe to the notification on BAT offset by using the "EventsSubscReqDataRm" data type including an event within the "events" attribute with the "event" attribute set to "BAT_OFFSET_INFO;

- interact with the PCF by triggering a Npcf_PolicyAuthorization_Update request to provision the related parameters to the PCF as defined in 3GPP TS 29.514 [20];

- if receiving a successful response from the PCF, the TSCSTF shall update the "Individual TSC Application Session Context" resource and send a "200 OK" or "204 No Content" response to the HTTP POST request to the NF service consumer, as shown in figure 5.3.2.3.2-1, step 2.

If the TSCTSF cannot successfully fulfil the received HTTP PATCH request due to the internal TSCTSF error or due to the error in the HTTP PATCH request, the TSCTSF shall send the HTTP error response as specified in clause 6.2.7.

The TSCTSF may send the following error responses based on failed AF-session update responses received from the PCF as specified in 3GPP TS 29.514 [20]:

a. If the updated service information is not acceptable for the PCF (e.g. the subscribed guaranteed bandwidth for a particular user is exceeded or the authorized data rate in that slice for the UE is exceeded), the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the received cause for the rejection including the "cause" attribute set to "REQUESTED_SERVICE_NOT_AUTHORIZED".

b. If the service information provided in the body of the HTTP POST request is rejected due to a temporary condition in the network, the TSCTSF may include in the "403 Forbidden" response the "cause" attribute set to "REQUESTED_SERVICE_TEMPORARILY_NOT_AUTHORIZED". The TSCTSF may also provide a received retry interval within the "Retry-After" HTTP header field. When the NF service consumer receives the retry interval within the "Retry-After" HTTP header field, the NF service consumer shall not send the same service information to the TSCTSF again (for the same application session context) until the retry interval has elapsed. The "Retry-After" HTTP header is described in 3GPP TS 29.500 [4] clause 5.2.2.2.

   The TSCTSF may additionally provide the acceptable bandwidth within the attribute "acceptableServInfo" included in the "ProblemDetailsTsctsfQosTscac" data structure returned in the rejection response message.

If the TSCTSF determines the received HTTP PATCH request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.3.2.3.3 Modification of Subscription to Service Data Flow QoS notification control

The NF service consumer shall use the HTTP PATCH method to update the "Events Subscription" sub-resource together with the modifications to the "Individual TSC Application Session Context" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall include the "events" attribute with the "QOS_GUARANTEED" and "QOS_NOT_GUARANTEED" values to indicate the subscription to QoS notification control or include the "events" but without the "QOS_GUARANTEED" and "QOS_NOT_GUARANTEED" values to indicate the termination of the subscription to QoS notification control.

As result of this action, the TSCTSF shall set the appropriate subscription to QoS notification control as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

The TSCTSF may send the following error responses based on the response to the provisioning of sponsored data connectivity information received from the PCF, as described in 3GPP TS 29.514 [20], as follows:

- HTTP "403 Forbidden" response message with the "cause" attribute set to "UNAUTHORIZED_SPONSORED_DATA_CONNECTIVITY", when received from the PCF.
- HTTP "403 Forbidden" response message the "cause" attribute set to "REQUESTED_SERVICE_NOT_AUTHORIZED", when received from the PCF.

5.3.2.3.4 Modification of Subscription to Service Data Flow Deactivation

The NF service consumer shall use the HTTP PATCH method to update the "Events Subscription" sub-resource together with the modifications to the "Individual TSC Application Session Context" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall include the "events" attribute with the "FAILED_RESOURCES_ALLOCATION" values to the subscription to service data flow deactivation or include the "events" but without "FAILED_RESOURCES_ALLOCATION" value to indicate the termination of the subscription to Service Data Flow Deactivation.

As result of this action, the TSCTSF shall set the appropriate subscription to QoS notification control as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

5.3.2.3.5 Modification of subscription to resources allocation outcome

The NF service consumer shall use the HTTP PATCH method to modify the "Events Subscription" sub-resource together with the modifications to the "Individual TSC Application Session Context" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall include the "events" attribute with the "SUCCESSFUL_RESOURCES_ALLOCATION" value for the successful resource allocation and/or "FAILED_RESOURCES_ALLOCATION" value for the unsuccessful resource allocation to the subscription to resources allocation outcome or include the "events" but without "SUCCESSFUL_RESOURCES_ALLOCATION" and/or "FAILED_RESOURCES_ALLOCATION" value to indicate the termination of the subscription to resources allocation outcome.

As result of this action, the TSCTSF shall set the appropriate subscription to resources allocation outcome as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

5.3.2.3.6 Modification of Subscription to Service Data Flow QoS Monitoring Information

The NF service consumer shall use the HTTP PATCH method to update the "Events Subscription" sub-resource together with the modifications to the "Individual TSC Application Session Context" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall perform as follows:

- to create a subscription to QoS monitoring information:

  a) include the "events" attribute with the "QOS_MONITORING" value; and

  b) include the updated QoS monitoring information within the "qosMon" attribute as defined in clause 5.3.2.2.6;

- to remove a subscription to QoS monitoring information:

  a) include the "events" attribute without "QOS_MONITORING".

As result of this action, the TSCTSF shall set the appropriate subscription to Service Data Flow QoS Monitoring Information as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

5.3.2.3.7 Modification of sponsored connectivity information

The NF service consumer shall use the HTTP PATCH method to modify the sponsored connectivity information.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, an application service provider identity and a sponsor identity within the "aspId" attribute and "sponId" attribute, and optionally an indication of whether to enable or disable sponsored data connectivity within the "sponStatus" attribute set to the applicable value to provide sponsored connectivity information or to update existing sponsored connectivity information.

If the NF service consumer requests to enable sponsored data connectivity the NF service consumer shall change the "sponStatus" attribute value to "SPONSOR_ENABLED".

If the NF service consumer requests to disable sponsored data connectivity the NF service consumer shall provide an indication to disable sponsored data connectivity to the TSCTSF by setting the "sponStatus" attribute to "SPONSOR_DISABLED".

To support the usage monitoring of sponsored data connectivity, the NF service consumer may also include in the HTTP PATCH a new or modified "evSubsc" attribute with:

- the usage thresholds to apply in the "usgThres" attribute; and
- an entry of the "events" attribute set to "USAGE_REPORT".

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2.

As result of this action, the TSCTSF shall provision the updated sponsored data connectivity information to the PCF as described in in 3GPP TS 29.514 [20].

5.3.2.3.8 Modification of AF requested QoS for a UE or group of UE(s) not identified by UE address(es)

When the "GMEC" feature is supported, the NF service consumer shall use the HTTP PATCH method to modify the requested QoS, traffic characteristics information and/or QoS Monitoring information for a UE or group of UE(s).

The NF service consumer shall include in the HTTP PATCH request message the parameters to be modified as defined in clause 5.3.2.3.2, with the following differences:

- To support the modification of the requested QoS, the traffic characteristics and monitoring of performance characteristics for a group of UE(s), the NF service consumer may modify:

- the event(s) subscription, including the QoS monitoring parameters, within the "evSubsc" attribute;
- the traffic characteristics and, if applicable, QoS parameters within the "tscQosReq" attribute;
- the QoS parameters, within either the "qosReference" attribute, the "altQosReferences" attribute or the "altQosReqs" attribute;
- the temporal invalidity conditions, within the "tempInValidity" attribute; and
- the flow description, within either the "flowInfo" attribute, the "ethFlowInfo" attribute or the "enEthFlowInfo" attribute.

The TSCTSF shall reply to the NF service consumer as defined in clause 5.3.2.3.2.

As a result of this procedure, the TSCTSF shall, for the list of matching AF session(s) associated to the "Individual TSC Application Session Context" resource, provision to the PCF the updated requested QoS, traffic characteristics and/or QoS Monitoring information by the triggering the Npcf_PolicyAuthorization_Update service operation as defined in 3GPP TS 29.514 [20].

5.3.2.3.9 Modification of Subscription to BAT offset notification

When the "EnTSCAC" feature is supported, this procedure is used to modify in the TSCTSF the subscription to the BAT offset information notification.

The NF service consumer shall use the HTTP PATCH method to update the "Events Subscription" sub-resource together with the modifications to the " Individual TSC Application Session" resource.

The NF service consumer shall include in the HTTP PATCH request message described in clause 5.3.2.3.2, the updated event subscription information within the "evSubsc" attribute. Within the EventsSubscReqDataRm data type, the NF service consumer shall include the "events" attribute with the "BAT_OFFSET_INFO" to indicate the subscription to changes of the BAT offset and the optionally adjusted periodicity.

As result of this action, the TSCTSF shall set the appropriate subscription to resources allocation outcome as described in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.3.2. The TSCTSF shall include the "evsNotif" attribute with an entry in the "evNotifs" array with the "event" attribute set to "BAT_OFFSET_INFO" and the "batOffsetInfo" attribute including the offset of the BAT and optionally an adjusted periodicity if the TSCTSF has previously subscribed with the PCF to changes in this information.

5.3.2.4 Ntsctsf_QoSandTSCAssistance_Delete

5.3.2.4.1 General

This service operation is used by an NF service consumer to request the network to delete the AF session with requested QoS or the AF session with requested QoS including Alternative Service Requirements.

The following procedures using the Ntsctsf_QoSandTSCAssistance_Delete service operation are supported:

- TSC AF application session context termination.
- Reporting usage for sponsored data connectivity.
- TSC AF application session context termination for a UE or group of UE(s) not identified by UE address(es).

5.3.2.4.2 TSC AF application session context termination

This procedure is used to terminate an AF application session context for the service as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.4.2-1 illustrates the application session context termination.

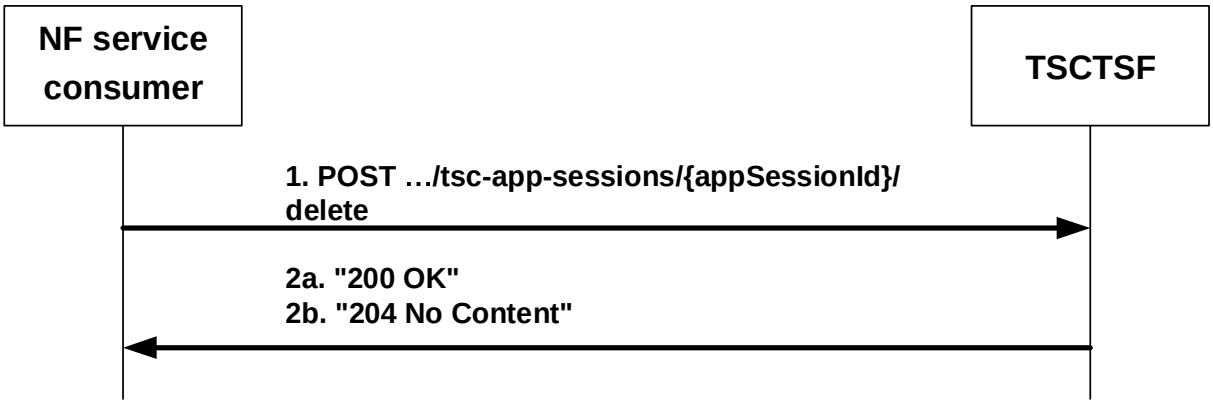

Figure 5.3.2.4.2-1: Application session context termination

When a TSC AF session is terminated, and if the TSC AF application session context was created as described in clause 5.3.2.2, the NF service consumer shall invoke the Ntsctsf_QoSandTSCAssistance_Delete service operation to the TSCTSF using an HTTP POST request, as shown in figure 5.3.2.4.2-1, step 1.

The NF service consumer shall set the request URI to "{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/delete".

The NF service consumer may include in the body of the HTTP POST the "EventsSubscReqData" data type with the "evSubsc" attribute indicating the corresponding list of events to subscribe to.

When the TSCTSF receives the HTTP POST request from the NF service consumer, indicating the termination of the TSC AF application session context information, the TSCTSF shall acknowledge that request by sending an HTTP response message with the corresponding status code.

If the HTTP POST request from the NF service consumer is accepted, the TSCTSF shall send to the NF service consumer:

a) if event information is reported, TSCTSF shall defer sending the response to the NF service consumer and shall immediately interact with the PCF to terminate the AF session with the event report, as specified in 3GPP TS 29.514 [20]. After receiving the event information from the PCF, the TSCTSF shall send a "200 OK" response to HTTP POST request, as shown in figure 5.3.2.4.2-1, step 2a, including in the "EventsNotification" to report to the NF service consumer;

b) otherwise, the TSCTSF shall send to the NF service consumer a "204 No Content".

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.2.7.

If the TSCTSF determines the received HTTP POST request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.3.2.4.3 Reporting usage for sponsored data connectivity

When The NF service consumer indicated to enable sponsored data connectivity and the NF service consumer provided usage thresholds for such sponsor to the TSCTSF, the TSCTSF shall report accumulated usage to the NF service consumer using the response of the Ntsctsf_QoSandTSCAssistance_Delete service operation.

This procedure is initiated when:

- the "Individual TSC Application Session" is deleted by the NF service consumer; or
- the TSCTSF requests the deletion of the "Individual TSC Application Session" to the NF service consumer, as described in clause 5.2.2.5.3, due to PDU session termination, the termination of all the service data flows of the Individual TSC Application Session.

To report the accumulated usage, the TSCTSF shall immediately configure the PCF to retrieve the accumulated usage as specified in 3GPP TS 29.514 [20]. When the TSCTSF receives the usage information from the PCF, the TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the response of the HTTP POST request as described in clause 5.3.2.4.2.

The TSCTSF shall within an instance of "events" attribute include:

- "USAGE_REPORT" within the "event" attribute;
- accumulated usage within the "usgRep" attribute.

5.3.2.4.4 Termination of AF requested QoS for a UE or group of UE(s) not identified by UE address(es)

When the "GMEC" feature is supported, the NF service consumer shall use the HTTP POST method to terminate the requested QoS, traffic characteristics information and/or QoS Monitoring information for a UE or group of UE(s) as defined in clause 5.3.2.4.2 with the following differences:

- The TSCTSF shall identify the affected AF session(s) and, for each AF session, interact with the PCF by triggering the Npcf_PolicyAuthorization_Delete service operation, as defined in 3GPP TS 29.514 [20], if the AF session is not associated with an "Individual Time Synchronization Exposure Subscription" resource.

5.3.2.5 Ntsctsf_QoSandTSCAssistance_Notify

5.3.2.5.1 General

The Ntsctsf_QoSandTSCAssistance_Notify service operation enables notification to NF service consumers that the previously subscribed event for the existing TSC application session context occurred or that the TSC application session context is no longer valid.

The following procedures using the Ntsctsf_QoSandTSCAssistance_Notify service operation are supported:

- Notification about TSC application session context event.
- Notification about TSC application session context termination.
- Notification about Service Data Flow QoS notification control.
- Notification about Service Data Flow Deactivation
- Notification about resources allocation outcome.
- Notification about Service Data Flow QoS Monitoring control.
- Reporting usage for sponsored data connectivity.
- Notification about AF requested QoS for a UE or group of UE(s) not identified by UE address(es).
- Notification about BAT offset.

5.3.2.5.2 Notification about TSC application session context event

This procedure is invoked by the TSCTSF to notify the NF service consumer when a certain, previously subscribed, application session context event occurs, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.5.2-1 illustrates the notification about TSC application session context event.

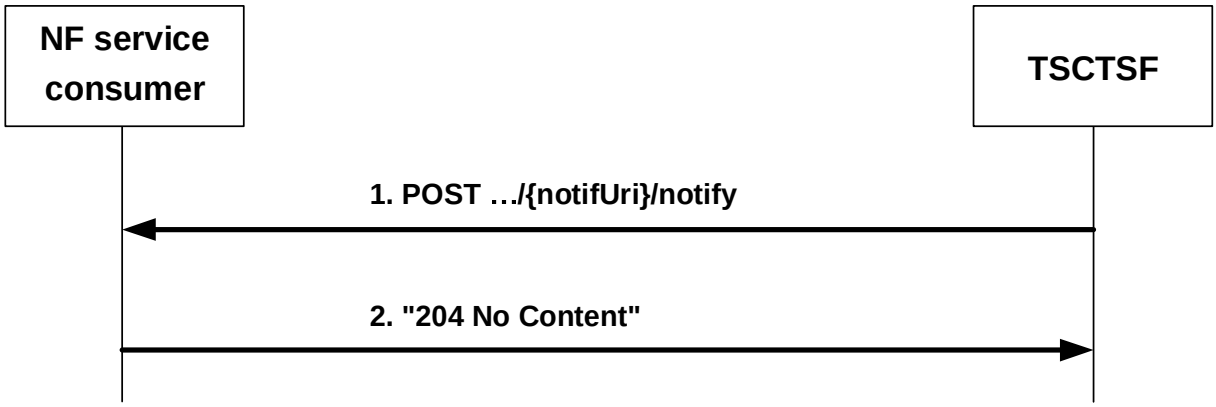

Figure 5.3.2.5.2-1: Notification about application session context event

When the TSCTSF determines that the event for the existing TSC AF application session context, to which the NF service consumer has subscribed to, occurred e.g. upon reception of an event notification for a PDU session from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall invoke the Ntsctsf_QoSandTSCAssistance_Notify service operation by sending the HTTP POST request (as shown in figure 5.3.2.5.2-1, step 1) to the NF service consumer using the notification URI received in the subscription creation (or modification), as specified in clause 5.3.2.2.2, 5.3.2.3.2, and 5.3.2.6, and appending the "notify" segment path at the end of the URI. The TSCTSF shall provide in the body of the HTTP POST request the "EventsNotification" data type including:

- the notification correlation Id within the "notifCorreId"; and
- the list of the reported events in the "events" attribute.

The NF service consumer notification of other specific events using the Ntsctsf_QoSandTSCAssistance_Notify request is described in the related clauses.

Upon the reception of the HTTP POST request from the TSCTSF indicating that the PDU session and/or service related event occurred, the NF service consumer shall acknowledge that request by sending an HTTP response message with the corresponding status code.

If the HTTP POST request from the TSCTSF is accepted, the NF service consumer shall acknowledge the receipt of the event notification with a "204 No Content" response to HTTP POST request, as shown in figure 5.3.2.5.2-1, step 2.

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.2.7.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [5].

5.2.2.5.3 Notification about TSC application session context termination

This procedure is invoked by the TSCTSF to notify the NF service consumer that the TSC application session context is no longer valid, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.2.2.5.3-1 illustrates the notification about application session context termination.

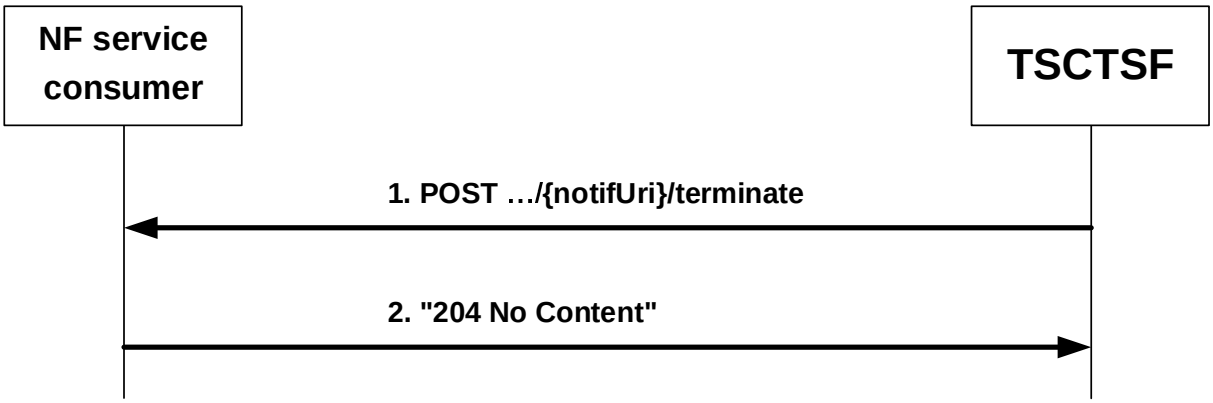

Figure 5.2.2.5.3-1: Notification about TSC application session context termination

When the TSCTSF determines that the TSC application session context is no longer valid, the TSCTSF shall invoke the Ntsctsf_QoSandTSCAssistance_Notify service operation by sending the HTTP POST request (as shown in figure 5.2.2.5.3-1, step 1) using the notification URI received in the "Individual TSC Application Session Context" context creation, as specified in clause 5.3.2.2, and appending the "terminate" segment path at the end of the URI, to trigger the NF service consumer to request the TSC application session context termination (see clause 5.3.2.4.2). The TSCTSF shall provide in the body of the HTTP POST request the "TerminationInfo" data type including:

- the Individual TSC Application Session Context resource identifier related to the termination notification in the "resUri" attribute; and
- the TSC application session context termination cause in the "termCause" attribute.

Upon the reception of the HTTP POST request from the TSCTSF requesting the TSC application session context termination, the NF service consumer shall acknowledge that request by sending an HTTP response message with the corresponding status code.

If the HTTP POST request from the TSCTSF is accepted, the NF service consumer shall acknowledge the receipt of the TSC application session context termination request with a "204 No Content" response to HTTP POST request (as shown in figure 5.2.2.5.3-1, step 2) and shall invoke the Ntsctsf_QoSandTSCAssistance_Delete service operation to the TSCTSF as described in clause 5.3.2.4.

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.2.7.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [5].

5.3.2.5.4 Notification about Service Data Flow QoS notification control

When the TSCTSF receives the notification about Service Data Flow QoS notification control from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer has previously subscribed as described in clauses 5.3.2.2.3 and 5.3.2.3.3.

The TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "QOS_GUARANTEED" or "QOS_NOT_GUARANTEED" within the "event" attribute;
- the identification of the affected service flows (if not all the flows are affected) encoded in the "flowIds" attribute if applicable; and

- the reference to the Alternative Service Requirement corresponding alternative QoS parameter set if received from the PCF within the "appliedQosRef" attribute. When the "appliedQosRef" attribute is omitted and the "event" attribute is QOS_NOT_GUARANTEED, it indicates that the lowest priority alternative QoS profile could not be fulfilled.

When the "AltQoSProfilesSupportReport" feature as defined in clause 6.2.8 is supported, and the NF service consumer included the "altQosReferences" attribute for the provided QoS reference, or the "altQosReqs" attribute for the provided individual QoS parameter set, if the TSCTSF receives from the PCF the indication that the GBR QoS targets cannot be guaranteed and the indication that alternative QoS profiles are not supported in the NG-RAN where the UE is currently located as specified in 3GPP TS 29.514 [20], the TSCTSF may include within the EventNotification data structure the "altQosNotSuppInd" attribute set to true. When the Alternative QoS profiles are supported by the NG-RAN where the UE is currently located, the TSCTSF may omit or set the "altSerReqNotSuppInd" attribute to false, as indicated by the PCF.

5.3.2.5.5 Notification about Service Data Flow Deactivation

When the TSCTSF receives the notification about service data flow deactivation from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer has previously subscribed as described in clauses 5.3.2.2.4 and 5.3.2.3.4.

The TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "FAILED_RESOURCES_ALLOCATION" within the "event" attribute;

- the identification of the affected service flows (if not all the flows are affected) encoded in the "flowIds" attribute if applicable.

5.3.2.5.6 Notification about resources allocation outcome

When the TSCTSF receives the notification about resources allocation outcome from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer has previously subscribed as described in clauses 5.3.2.2.5 and 5.3.2.3.5.

The TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "SUCCESSFUL_RESOURCES_ALLOCATION" within the "event" attribute if the "SUCCESSFUL_RESOURCES_ALLOCATION" event is received from the PCF or "FAILED_RESOURCES_ALLOCATION" within the "event" attribute if the "FAILED_RESOURCES_ALLOCATION" event is received from the PCF;

- the identification of the affected service flows (if not all the flows are affected) encoded in the "flowIds" attribute if applicable.

- when the event is "SUCCESSFUL_RESOURCES_ALLOCATION", the reference to the Alternative Service Requirement corresponding alternative QoS parameter set if received from the PCF within the "appliedQosRef" attribute.

5.3.2.5.7 Notification about Service Data Flow QoS Monitoring control

When the TSCTSF receives the notification about Service Data Flow QoS Monitoring control from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer has previously subscribed as described in clauses 5.3.2.2.6 and 5.3.2.3.6 and 5.3.2.6.3.

The TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "QOS_MONITORING" within the "event" attribute;
- the identification of the affected service flows (if not all the flows are affected) encoded in the "flowIds" attribute if applicable; and
- the "qosMonReports" array with the monitored QoS information. For QoS monitoring for packet delay:
  a) the uplink packet delays within the "ulDelays" attribute;
  b) the downlink packet delays within the "dlDelays" attribute; and/or
  c) the round trip packet delays within the "rtDelays" attribute; or
  d) if the feature "PacketDelayFailureReport" is supported, the packet delay measurement failure indicator within "pdmf" attribute.

NOTE: The PCF reports one UL, DL and/or round-trip packet delay measurement for each periodic and/or event-triggered report as described in 3GPP TS 29.514 [20]. I.e, the TSCTSF can include only one element within the "ulDelays", "dlDelays", and/or "rtDelays" array(s) respectively, each one with the received report from the PCF for the UL, DL and/or round trip delay(s).

5.3.2.5.8 Reporting usage for sponsored data connectivity

When the NF service consumer enabled sponsored data connectivity and the NF service consumer provided usage thresholds for such sponsor to the TSCTSF, the TSCTSF shall report accumulated usage to the NF service consumer using the Ntsctsf_QoSandTSCAssistance_Notify service operation when:

- the TSCTSF detects that the usage threshold provided by the NF service consumer has been reached; or
- the NF service consumer disables the sponsored data connectivity.

The TSCTSF shall notify the NF service consumer of the accumulated usage by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall within an instance of "events" attribute include:

- "USAGE_REPORT" within the "event" attribute;
- accumulated usage within the "usgRep" attribute.

When the NF service consumer receives the HTTP POST request, it shall acknowledge the request by sending a "204 No Content" response to the TSCTSF. The NF service consumer may terminate the Individual TSC Application Session Context sending an HTTP POST as described in clause 5.3.2.4.2 or update the Individual TSC Application Session Context information by providing a new usage threshold sending an HTTP PATCH request to the TSCTSF as described in clause 5.3.2.3.2 or an HTTP PUT request to the TSCTSF as described in clause 5.3.2.6.2.

5.3.2.5.9 Notification about AF requested QoS for a UE or group of UE(s) not identified by UE address(es).

When the TSCTSF receives from the PCF, as defined in 3GPP TS 29.514 [20], a notification on event(s) related to the requested QoS, traffic characteristics information and/or QoS monitoring information for a UE or group of UE(s) not identified by UE address(es) for an AF-session associated with an existing "Individual TSC Application Session Context" resource, the TSCTSF shall notify the NF service consumer accordingly by including the EventsNotification data structure in the body of the HTTP POST request as defined in clause 5.3.2.5.2, if the NF service consumer has previously subscribed for such event(s) as defined in clauses 5.3.2.2.8 and 5.3.2.3.8.

The TSCTSF notification of the specific event(s) is described in the related clauses of the current specification (e.g., notification about service data flow QoS monitoring, as defined in clause 5.3.2.5.7).

5.3.2.5.10 Notification about BAT offset

When the TSCTSF receives the notification about network provided BAT offset from the PCF as described in 3GPP TS 29.514 [20], the TSCTSF shall inform the NF service consumer accordingly if the NF service consumer

included the capability for BAT adaptation or a BAT window or the periodicity range as described in the clauses 5.3.2.2.8 and 5.3.2.3.8.

The TSCTSF shall notify the NF service consumer by including the "EventsNotification" data type in the body of the HTTP POST request as described in clause 5.3.2.5.2.

The TSCTSF shall include:

- in the "events" attribute an entry with the "event" attribute set to "BAT_OFFSET_INFO"; and
- the "batOffsetInfo" attribute containing the offset of the BAT and the optionally adjusted periodicity. The "BatOffsetInfo" data type shall contain the BAT offset of the arrival time in the "ranBatOffsetNotif" attribute, and the optionally adjusted periodicity of the data bursts encoded in the "adjPeriod" attribute.

5.3.2.6 Ntsctsf_QoSandTSCAssistance_Subscribe

5.3.2.6.1 General

The Ntsctsf_QoSandTSCAssistance_Subscribe service operation enables NF service consumers handling of subscription to events for the existing TSC application session context. Subscription to events shall be created:

- within the TSC application session context establishment procedure by invoking the Ntsctsf_QoSandTSCAssistance_Create service operation, as described in clause 5.3.2.2; or
- within the TSC application session context modification procedure by invoking the Ntsctsf_QoSandTSCAssistance_Update service operation, as described in clause 5.3.2.3; or
- by invoking the Ntsctsf_QoSandTSCAssistance_Subscribe service operation for the existing TSC application session context, as described in clause 5.3.2.6.2.

The following procedures using the Ntsctsf_QoSandTSCAssistance_Subscribe service operation is supported:

- Handling of subscription to events for the existing TSC application session context.
- Subscription to Service Data Flow QoS Monitoring Information.
- Subscription to Usage Monitoring of Sponsored Data Connectivity.

5.3.2.6.2 Handling of subscription to events for the existing TSC application session context

This procedure is used to create a subscription to events for the existing TSC AF application session context bound to the corresponding PDU session or to modify an existing subscription, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.6.2-1 illustrates the creation of events subscription information using HTTP PUT method.

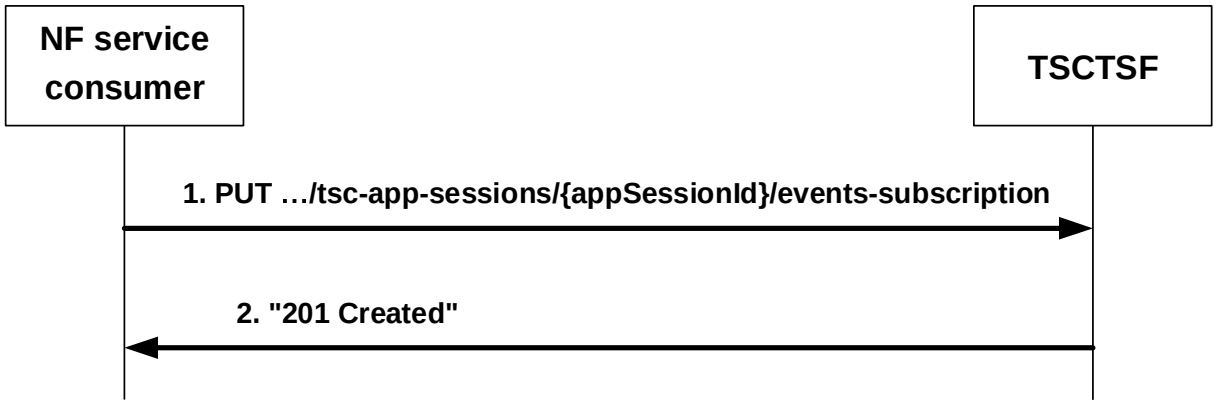

Figure 5.3.2.6.2-1: Creation of events subscription information using HTTP PUT

Figure 5.3.2.6.2-2 illustrates the modification of events subscription information using HTTP PUT method.

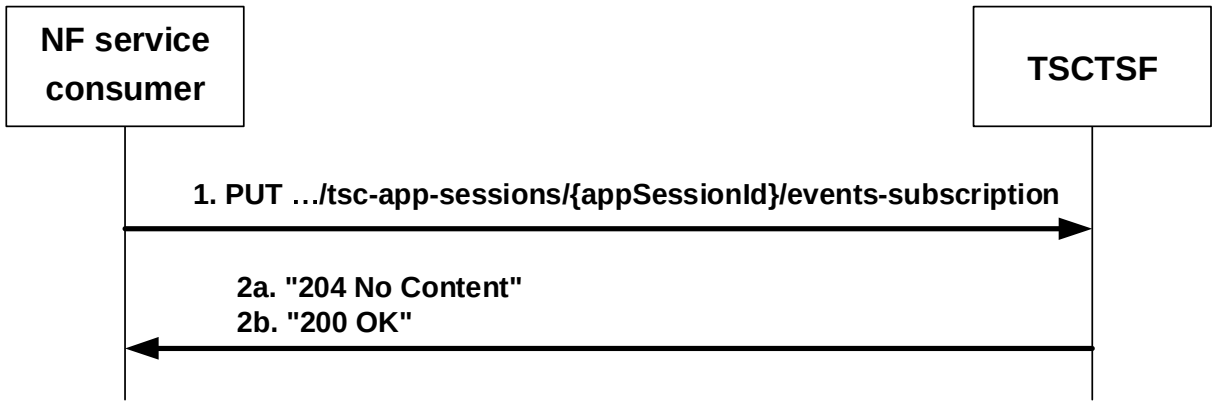

Figure 5.3.2.6.2-2: Modification of events subscription information using HTTP PUT

When the NF service consumer decides to create a subscription to one or more events for the existing TSC application session context or to modify an existing subscription previously created by itself at the TSCTSF, the NF service consumer shall invoke the Ntsctsf_QoSandTSCAssistance_Subscribe service operation by sending the HTTP PUT request to the resource URI representing the "Events Subscription" sub-resource in the TSCTSF, as shown in figure 5.3.2.6.2-1, step 1 and figure 5.3.2.6.2-2, step 1. The NF service consumer shall provide in the "EventsSubscReqData" data type of the body of the HTTP PUT request:

- the "events" attribute with the list of events to be subscribed;
- the "notifUri" attribute that includes the Notification URI to indicate to the TSCTSF where to send the notification of the subscribed events;
- the notification correlation Id within the "notifCorreId" attribute; and
- the specific event information related to the subscribed event, e.g. QoS monitoring information within the "qosMon" attribute if the "QOS_MONITORING" event is subscribed.

NOTE: The "notifUri" attribute within the EventsSubscReqData data structure can be modified to request that subsequent notifications are sent to a new NF service consumer.

Upon the reception of the HTTP PUT request from the NF service consumer, the TSCTSF shall decide whether the received HTTP PUT request is accepted.

If the TSCTSF accepted the HTTP PUT request to create a subscription to events, the TSCTSF shall create the "Events Subscription" sub-resource and shall send the HTTP response message to the NF service consumer as shown in figure 5.3.2.6.2-1, step 2. The TSCTSF shall include in the "201 Created" response:

- a Location header field that shall contain the URI of the created "Events Subscription" sub-resource i.e. "{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/events-subscription"; and

- a response body with the "EventsSubscReqData" data type representing the created "Events Subscription" sub-resource.

If the TSCTSF accepted the HTTP PUT request to modify the events subscription, the TSCTSF shall modify the "Events Subscription" sub-resource and shall send to the NF service consumer:

- the HTTP "204 No Content" response (as shown in figure 5.3.2.6.2-2, step 2a); or

- the HTTP "200 OK" response (as shown in figure 5.3.2.6.2-2, step 2b) including in the "EventsSubscReqData" data type the updated representation of the "Events Subscription" sub-resource.

If the HTTP PUT request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP PUT request the cause for the rejection as specified in clause 6.2.7.

If the TSCTSF determines the received HTTP PUT request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.3.2.6.3 Subscription to Service Data Flow QoS Monitoring Information

This procedure is used by NF service consumer to subscribe and/or modify the subscription for notification about service data flow QoS monitoring information.

The NF service consumer shall include in the HTTP PUT request message the "EventsSubscReqData" data type, which shall contain:

- to create a subscription to QoS monitoring information:

  - the "events" attribute with an entry containing the value "QOS_MONITORING" to create a subscription to notification about service data flow QoS monitoring information;

  - include the updated QoS monitoring information within the "qosMon" attribute as defined in clause 5.3.2.2.6

- to remove a subscription to QoS monitoring information:

  - the "events" attribute containing an array that omits the values "QOS_MONITORING".

The NF service consumer shall include other events related information as described in clause 5.3.2.6.1.

As result of this action, the TSCTSF shall set the appropriate subscription to service data flow QoS monitoring information as described in in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.6.1.

5.3.2.6.4 Subscription to Usage Monitoring of Sponsored Data Connectivity

This procedure is used by NF service consumer to subscribe and/or modify the subscription for notification about usage monitoring of sponsored data connectivity.

The NF service consumer shall include in the HTTP PUT request message the "EventsSubscReqData" data type, which shall contain:

- to create a subscription to usage monitoring of sponsored data connectivity:

  - the "events" attribute with an entry containing the value "USAGE_REPORT" to create a subscription to notification about usage monitoring of sponsored data connectivity;

  - include the usage thresholds to apply in the "usgThres" attribute.

- to remove a subscription to usage monitoring of sponsored data connectivity:

- the "events" attribute containing an array that omits the values "USAGE_REPORT".

The NF service consumer shall include other events related information as described in clause 5.3.2.6.1.

As result of this action, the TSCTSF shall set the appropriate subscription to usage monitoring of sponsored data connectivity as described in in 3GPP TS 29.514 [20].

The TSCTSF shall reply to the NF service consumer as described in clause 5.3.2.6.1.

5.3.2.7 Ntsctsf_QoSandTSCAssistance_Unsubscribe

5.3.2.7.1 General

The Ntsctsf_QoSandTSCAssistance_Unsubscribe service operation enables NF service consumers to remove subscription to all subscribed events for the existing TSC application session context. Subscription to events shall be removed:

- by invoking the Ntsctsf_QoSandTSCAssistance_Unsubscribe service operation for the existing application session context, as described in clause 5.3.2.7.2; or
- within the application session context modification procedure by invoking the Ntsctsf_QoSandTSCAssistance_Update service operation, as described in clause 5.3.2.3; or
- within the TSC application session context termination procedure by invoking the Ntsctsf_QoSandTSCAssistance_Delete service operation, as described in clause 5.3.2.4.

The following procedure using the Ntsctsf_QoSandTSCAssistance_Unsubscribe service operation is supported:

- Unsubscription to events.

5.3.2.7.2 Unsubscription to events

This procedure is used to unsubscribe to all subscribed events for the existing TSC AF application session context, as defined in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.503 [19].

Figure 5.3.2.7.2-1 illustrates the unsubscription to events using the HTTP DELETE method.

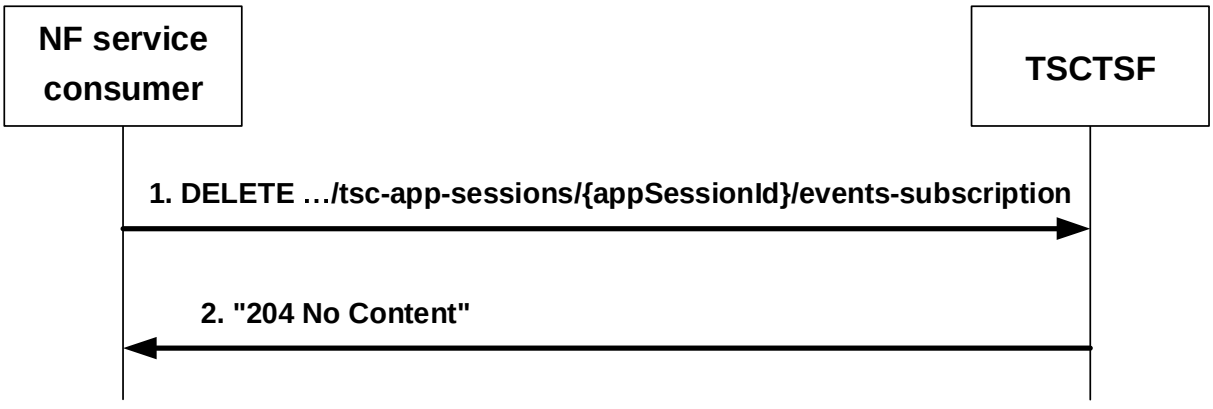

Figure 5.3.2.7.2-1: Removal of events subscription information using HTTP DELETE

When the NF service consumer decides to unsubscribe to all subscribed events for the existing TSC application session context, the NF service consumer shall invoke the Ntsctsf_QoSandTSCAssistance_Unsubscribe service operation by sending the HTTP DELETE request message to the resource URI representing the "Events Subscription" sub-resource in the TSCTSF, as shown in figure 5.3.2.7.2-1, step 1.

Upon the reception of the HTTP DELETE request message from the NF service consumer, the TSCTSF shall decide whether the received HTTP request message is accepted.

If the HTTP DELETE request message from the NF service consumer is accepted, the TSCTSF shall delete "Events Subscription" sub-resource and shall send to the NF service consumer a HTTP "204 No Content" response message. The TSCTSF may delete the existing subscription to event notifications for the related PDU session from the PCF as described in 3GPP TS 29.514 [20].

If the HTTP DELETE request from the NF service consumer is not accepted, the TSCTSF shall indicate in the response to HTTP DELETE request the cause for the rejection as specified in clause 6.2.7.

If the TSCTSF determines the received HTTP DELETE request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.4 Ntsctsf_ASTI Service

5.4.1 Service Description

5.4.1.1 Overview

This service provides:

- Authorization of NF Service Consumer requests for the activation, update, and deactivation of the 5G access stratum time distribution.

NOTE: The AF can use either the procedure specified in bullet 1) and 2) of clause 5.2.1.1 for configuring the (g)PTP instance in 5GS or the procedure specified in Ntsctsf_ASTI service for controlling the 5G access stratum time distribution for a particular UE. The procedures are not intended to be used in conjunction.

- Detection and reporting of time synchronization service status based on gNB and/or UPF/NW-TT timing synchronization status information and reporting status updates.

- Detection and reporting of changes of the state of 5G access time distribution configuration based e.g. on evaluation of the time synchronization coverage area conditions.

5.4.1.2 Network Functions

5.4.1.2.1 TSCTSF

The TSCTSF supports to:

- receive the request to activate or update the 5G access stratum time distribution configuration from the NEF or AF and provide it for the target UE(s) to the PCF;

- receive the request to delete the 5G access stratum time distribution configuration from the NEF or AF and provide it for the target UE(s) to the PCF;

- receive the request to query the status of the access stratum time distribution from the NEF or AF and respond to the NEF or AF with the status of the access stratum time distribution;

- make a translation from External/Internal Group Identifier to a list of SUPI by querying UDM;

- retrieve the Time Synchronization Subscription data from UDM for the control of 5G access stratum-based time distribution and make decision based on received the Time Synchronization Subscription data;

- determine whether the UE is inside/outside the authorized time synchronization coverage area and/or within the authorized time period and enforce the 5G access stratum time distribution service accordingly;

- indicate whether the service is supported or not as per the requested acceptance criteria (e.g., based on the known timing synchronization status attribute thresholds pre-configured at gNB); and

- based on gNB and/or UPF/NW-TT timing synchronization status (degradation/failure/improvement) information and reporting, provide a notification when there is a service status update if the NEF or AF subscribe to service status updates.

5.4.1.2.2 NF Service Consumers

The NF service consumer supports to:

- send the request to create, modify and delete the 5G access stratum time distribution configuration to the TSCTSF;
- query the status of the access stratum time distribution configuration;
- provide clock quality reporting control information, consisting of clock quality detail level and, if applicable, clock quality acceptance criteria, during activation or modification of time synchronization service;
- subscribe to time synchronization service status for the target UE(s) when provided the clock quality reporting control information contains acceptance indication; and
- receive notifications about the state and changes of state of 5G access stratum time distribution configuration.

5.4.2 Service Operations

5.4.2.1 Introduction

Service operations defined for the Ntsctsf_ASTI service are shown in table 5.4.2.1-1.

Table 5.4.2.1-1: Ntsctsf_ASTI Service Operations

Service Operation Name	Description	Initiated by
Ntsctsf_ASTI_Create	Allows the NF service consumer to create a 5G access stratum time distribution configuration and optionally subscribe for 5G access stratum time distribution status.	NF service consumer (e.g. AF, NEF)
Ntsctsf_ASTI_Update	Allows the NF service consumer to update a 5G access stratum time distribution configuration and optionally subscribe for 5G access stratum time distribution status.	NF service consumer (e.g. AF, NEF)
Ntsctsf_ASTI_Delete	Allows the NF service consumer to delete a 5G access stratum time distribution configuration and related subscription for 5G access stratum time distribution status.	NF service consumer (e.g. AF, NEF)
Ntsctsf_ASTI_Get	Allows the NF service consumer to query the status of the 5G access stratum time distribution configuration.	NF service consumer (e.g. AF, NEF)
Ntsctsf_ASTI_UpdateNotify	Allows the TSCTSF to notify about the status of the 5G access stratum time distribution and/or changes on the state of 5G access stratum time distribution configuration.	TSCTSF

NOTE: The NEF and the AF use the Ntsctsf_ASTI service in the same way.

5.4.2.2 Ntsctsf_ASTI_Create

5.4.2.2.1 General

This service operation is used by an NF service consumer to create a 5G access stratum time distribution configuration.

The following procedures using the Ntsctsf_ASTI_Create service operation are supported:

- creating a new configuration.

5.4.2.2.2 Creating a new configuration

Figure 5.4.2.2.2-1 illustrates the creation of a configuration.

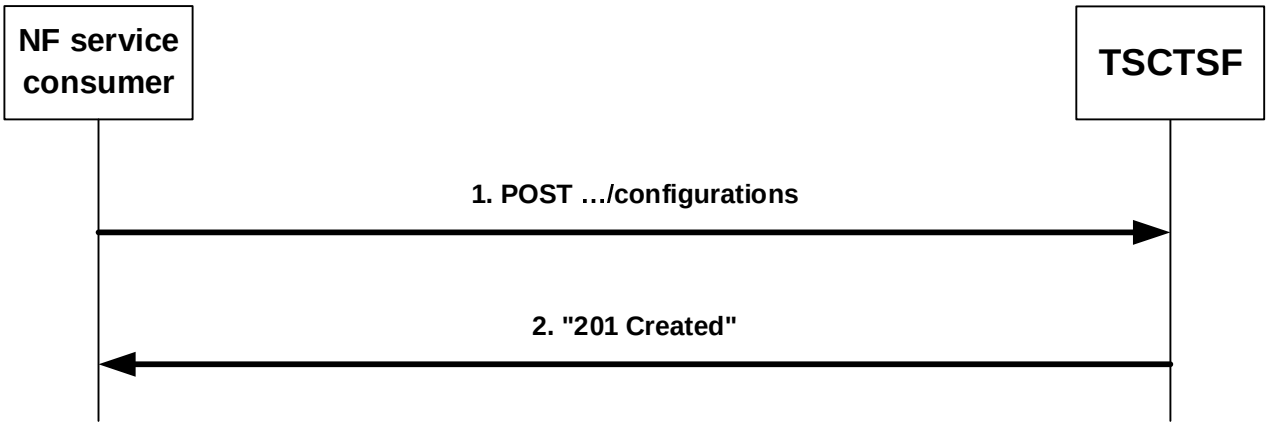

Figure 5.4.2.2.2-1: Creation of a configuration

To create a configuration, the NF service consumer shall send an HTTP POST message to the TSCTSF to the URI "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations". The HTTP POST message shall include the AccessTimeDistributionData data structure as request body, as shown in figure 5.4.2.2.2-1, step 1. The AccessTimeDistributionData data structure shall include:

- one of the indication of the UEs to which the 5G access stratum time distribution configuration is requested via:
  - identification of a list of individual UEs within the "supis" attribute; or
  - identification of a group of UE(s) within the "interGrpId" attribute;
  - identification of a list of individual UEs within the "gpsis" attribute;
  - identification of a group of UE(s) within the "exterGrpId" attribute; and
- 5G access stratum time distribution parameters within the "asTimeDisParam" attribute.

Within the "asTimeDisParam" attribute inside the AccessTimeDistributionData data structure, the NF service consumer:

- shall include the "asTimeDisEnabled" attribute set to true if the access stratum time distribution via Uu reference point should be activated. Otherwise, if the access stratum time distribution via Uu reference point should be inactive, the "asTimeDisEnabled" attribute may either be omitted or included and set to "false";
- may include the time synchronization error budget within the "timeSyncErrBdgt" attribute;
- may include the temporal validity condition within the "tempValidity" attribute; and
- if the "NetTimeSyncStatus" feature is supported, may indicate whether and which clock quality information to provide to the UE by including the clock quality detail level in the "clkQltDetLvl" attribute and optionally the clock quality acceptance criteria in the "clkQltAcptCri" attribute, if applicable.

When the "CoverageAreaSupport" feature is supported, the AccessTimeDistributionData data structure may include the time synchorinization coverage area encoded as "covReq" attribute, that contains a list of Tracking Area codes per serving network where the provided 5G access stratum time distribution data applies.

When the "ASTIConfigReport" feature is supported, to receive notifications about changes in the 5G access stratum time distribution configuration, the NF service consumer shall also provide the notification URI within the "astiNotifUri" attribute and the notification correlation Id within the "astiNotifId" attribute. When the "NetTimeSyncStatus" feature is supported, the NF service consumer shall provide the clock quality acceptance criteria in the "clkQltAcptCri" attribute to indicate the subscription to the notification of the status of the 5G access stratum time distribution service.

Upon receipt of the HTTP request from the NF service consumer, if the request is authorized, the TSCTSF shall:

- if the 5G access stratum time distribution configuration applies to an internal group of UEs indicated in the "interGrpId" attribute or to an external group of UEs indicated in the "exterGrpId" attribute, interact with the

UDM to retrieve the list of individual UEs that belong to the group using the Nudm_SDM service as defined in 3GPP TS 29.503 [24];

- if the 5G access stratum time distribution configuration applies to a list of individual UEs within the "gpsis" attribute, interact with the UDM to retrieve the SUPI(s) that corresponds to each of the GPSI(s) using the Nudm_SDM service as defined in 3GPP TS 29.503 [24];

- retrieve the UE's Time Synchronization Subscription data from the UDM for each individual UE:

  a. if the UE's Time Synchronization Subscription data indicates that the UE(s) are allowed for AF-provided ASTI based stime synchronization service, the TSCTSF shall determine that the UE(s) are authorized for the requested time synchronization service;

  b. if the UE(s) are allowed for AF-provided ASTI service and the UE's Time Synchronization Subscription data contains the authorized Uu time synchronization error budget, and the requested time synchronization error budget within the "timeSyncErrBdgt" attribute is within the authorized time synchronization error budget, the TSCTSF shall determine that the UE(s) are authorized for the requested time synchronization service;

- If the "CoverageAreaSupport" feature is supported and a time synchronization coverage area is provided within the "covReq" attribute, perform the following operations:

  a. if the UE's Time Synchronization Subscription data from the UDM contains the list of TA(s) that comprise the authorized time synchronization Coverage Area, if the requested Coverage Area is inside of the authorized Time Synchronization Coverage Area, the TSCTSF uses the Authorized Time Synchronization Coverage Area. If the requested Coverage Area partly overlaps with the Authorized Time Synchronization Coverage Area, the TSCTSF uses the intersection of them. If there is no overlap between them, the TSCTSF shall reject the AF request as described in clause 5.27.1.11 of 3GPP TS 23.501 [2].

  b. the TSCTSF shall discover the list of AMF(s) serving the list of TA(s) that comprise the time synchronization coverage area using the Nnrf_NFDiscovery service operation as described in 3GPP TS 29.510 [10], if they were not previously retrieved, and:

  c. subscribe with the discovered AMF(s):

     1. for each UE, e.g. when the 5G access stratum time distribution configuration applies to a list of individual UEs, and the UE time synchronization coverage area within the "covReq" attribute is within the authorized time synchronization coverage area; or

     2. for the group of UEs, when the 5G access stratum time distribution configuration applies to a group of UEs.

     To receive notifications about presence of the UE in an Area of Interest events using the Namf_EventExposure service as described in 3GPP TS 29.518 [27], where the Area of Interest is the provided time synchronization coverage area.

  d. Based on the outcome provided by the AMF about the UE’s presence in the Area of Interest and the authorized time synchronization coverage area, the TSCTSF shall determine if the 5G access stratum time distribution configuration is enabled for the UE:

     i. If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is fulfilled, and the provided 5G access stratum time distribution configuration is enabled for the UE.

     ii. If the UE presence is not within any of the TAs from the time synchronization coverage area, the TSCTSF determines that the time synchronization coveragae area condition is not fulfilled, and the provided 5G access stratum time distribution configuration is not enabled for the UE.

- If the UE's Time Synchronization Subscription data contains the periods of authorized start and stop times, and the requested temporal validity condition within the "tempValidity" attribute is within any of the authorized periods of authorized start and stop times, the TSCTSF determines that the UE is authorized for the requested time synchronization service.

- The TSCTSF retrieves the UE's Time Synchronization Subscription data from the UDM for each individual UE. If the UE's Time Synchronization Subscription data contains the clock quality detail level and clock quality acceptance criteria, and if the "NetTimeSyncStatus" feature is supported and the requested clock quality detail

level within the "clkQltDetLvl" attribute and optionally the clock quality acceptance criteria in the "clkQltAcptCri" attribute are within any of the authorized clock quality detail level and the clock quality acceptance criteria, the TSCTSF determines that the UE is authorized for the requested time synchronization service.

NOTE: Each parameter in the AF requested clock quality information is evaluated individually, if the TSCTSF determines that at least one parameter within the "clkQltAcptCri" attribute is not acceptable, the TSCTSF shall reject the AF request as described in clause 5.27.1.11 of 3GPP TS 23.501 [2].

- for each authorized UE, subscribe to event notifications of newly registered PCF for the UE by invoking Nbsf_Management_Subscribe Service Operation as defined in 3GPP TS 29.521 [23], if not yet subscribed;

- for each authorized UE, if the 5G access stratum time distribution via Uu reference point is being activated (i.e. the "asTimeDisEnabled" attribute within the "asTimeDisParam" attribute was received and set to true), calculate the Uu time synchronization error budget as specified in clauses 5.27.1.9 and 5.27.1.11 of 3GPP TS 23.501 [2];

- for each authorized UE, if clock quality information was provided, the authorized clock quality detail level within the "clkQltDetLvl" attribute and optionally the clock quality acceptance criteria in the "clkQltAcptCri" attribute, if applicable;

- for each authorized UE, interact with the PCF for a UE to provide the configuration information for each target UE using the Npcf_AMPolicyAuthorization_Create service operation as defined in 3GPP TS 29.534 [14];

- create a new resource, which represents a new "Individual ASTI Configuration" resource, addressed by a URI as defined in clause 6.1.3.7 and containing a TSCTSF created resource identifier; and

- send an HTTP "201 Created" response with AccessTimeDistributionData data structure as response body and a Location header field containing the URI of the created Individual ASTI Configuration resource, i.e. "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}", as shown in figure 5.4.2.2.2-1, step 2.

If the feature "SupportReport" is supported, and if the AF request is not authorized or the AF requested parameter(s) are not allowed by UE's Time Synchronization Subscription Data in UDM, the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE_SERVICE_NOT_AUTHORIZED".

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.3.7.

5.4.2.3 Ntsctsf_ASTI_Update

5.4.2.3.1 General

This service operation is used by an NF service consumer to update a 5G access stratum time distribution configuration.

The following procedures using the Ntsctsf_ASTI_Update service operation are supported:

- Updating an existing configuration.

5.4.2.3.2 Updating an existing configuration

Figure 5.4.2.3.2-1 illustrates the updating of an existing configuration.

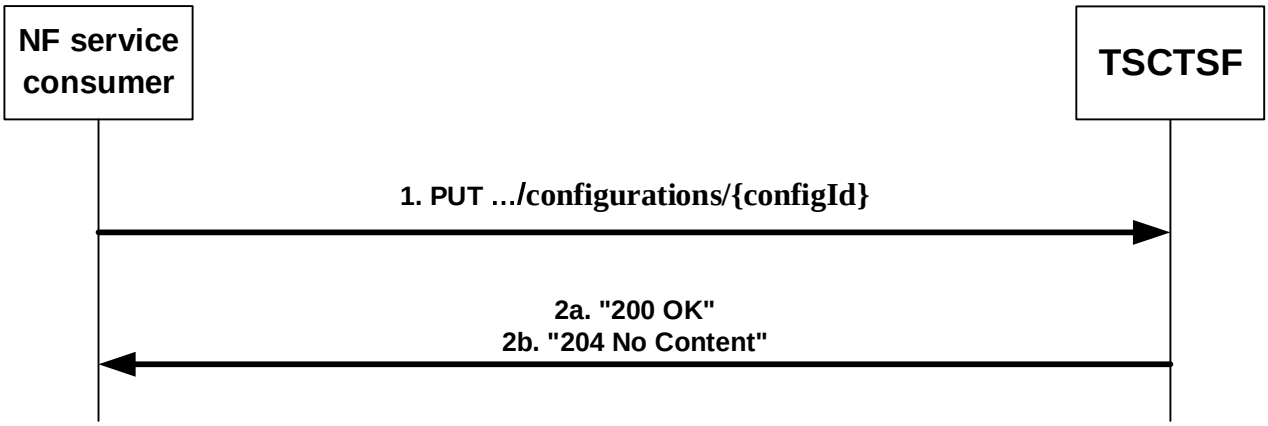

Figure 5.4.2.3.2-1: Update of a configuration

To update a configuration, the NF service consumer shall send an HTTP PUT request to the resource "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}" representing an existing "Individual ASTI Configuration" resource, as shown in figure 5.4.2.3.2-1, step 1, to modify the configuration.

The AccessTimeDistributionData data structure provided in the request body shall include an updated representation of the "Individual ASTI Configuration" resource with the updated 5G access stratum time distribution configuration information as defined in clause 5.4.2.2.2.

When the "CoverageAreaSupport" feature is supported, the AccessTimeDistributionData data structure may include the time synchronization coverage area encoded as "covReq" attribute, that may contain an updated list of Tracking Area codes per serving network where the provided 5G access stratum time distribution data applies.

When the "ASTIConfigReport" feature is supported, to receive notifications about changes in the 5G access stratum time distribution configuration, the NF service consumer shallprovide the notification URI within the "astiNotifUri" attribute and the notification correlation Id within the "astiNotifId" attribute, if not previously provided, or may update the previously provided ones; and/or, when the "NetTimeSyncStatus" feature is supported, may provide or update the clock quality detail level in the "clkQltDetLvl" attribute and optionally the clock quality accpetance criteria in the "clkQltAcptCri" attribute.

Upon receipt of the corresponding HTTP PUT message, if the request is authorized, theTSCTSF shall:

- If the "CoverageAreaSupport" feature is supported and an updated time synchronization coverage area is provided within the "covReq" attribute, if the UE's Time Synchronization Subscription Data from the UDM contains the list of TA(s) that comprise the authorized time synchronization coverage area, determine the applicable time synchronization coverage area as described in clause 5.4.2.2.2 and:

  i. discover the list of AMF(s) serving the list of TA(s) that comprise the time synchronization coverage area using the Nnrf_NFDiscovery service operation as described in 3GPP TS 29.510 [10], if they were not previously retrieved, and:

  ii. update the subscription with the discovered AMF(s), if applicable:

    a. for each affected UE, e.g. when the 5G access stratum time distribution configuration applies to a list of individual UEs and the UE time synchronization coverage area within the "covReq" attribute is within the subscribed time synchronization coverage area; or

    b. for the group of UEs, when the 5G access stratum time distribution configuration applies to a group of UEs.

    to receive notifications about presence of the UE in an Area of Interest events using the Namf_EventExposure service as described in 3GPP TS 29.518 [27], where the Area of Interest is the provided time synchronization coverage area.

  iii. Based on the outcome provided by the AMF or the local available information about the UE’s presence in the Area of Interest and the authorized time synchronization coverage area, the TSCTSF shall determine if the 5G access stratum time distribution configuration is enabled for the UE:

i. If the UE presence is within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is fulfilled, and the provided 5G access stratum time distribution configuration is enabled for the UE.

ii. If the UE presence is not within any of the TAs from the authorized time synchronization coverage area, the TSCTSF determines that the time synchronization coverage area condition is not fulfilled, and the provided 5G access stratum time distribution configuration is not enabled for the UE.

- if the "CoverageAreaSupport" feature is supported and a time synchronization coverage area previously provided is removed:

1. terminate the related subscriptions to notifications about presence of the UE in an Area of Interest events using the Namf_EventExposure service as described in 3GPP TS 29.518 [27].

2. for each UE that did not fulfil the removed time synchronization coverage area, authorize the UE for the 5G access stratum time distribution configuration.

- if the time synchronization error budget within the "timeSyncErrBdgt" attribute, the temporal validity condition within the "tempValidity" attribute, and/or, if the "NetTimeSyncStatus" feature is supported, the clock quality reporting control information in the "clkQltDetLvl" attribute and, optionally the clock quality acceptance criteria in the "clkQltAcptCri" attribute are provided, updated, or removed, the TSCTSF based on the Time Synchronization Subscription data retrieved from the UDM determines whether the UE is authorized for the request again as described in clause 5.4.2.2.2.

- for each authorized UE, if the 5G access stratum time distribution via Uu reference point is being activated (i.e. the "asTimeDisEnabled" attribute within the "asTimeDisParam" attribute was received and set to true) or a time synchronization error budget for an active 5G access stratum time distribution is provided or updated by the AF, calculate the Uu time synchronization error budget as specified in clause 5.27.1.9 of 3GPP TS 23.501 [2];

- for each authorized UE, interact with the PCF for a UE to provide the updated configuration information using the Npcf_AMPolicyAuthorization_Update service operation as defined in 3GPP TS 29.534 [14]; and

- update the existing "Individual ASTI Configuration" resource. Then the TSCTSF shall send a HTTP response including "200 OK" status code with AccessTimeDistributionData data structure or "204 No Content" status code, as shown in figure 5.4.2.3.2-1, step 2.

If the feature "SupportReport" is supported, and if the AF request is not authorized or the AF requested parameter(s) are not allowed by UE's Time Synchronization Subscription Data in UDM, the TSCTSF shall indicate in an HTTP "403 Forbidden" response message the "cause" attribute set to "UE_SERIVCE_NOT_AUTHORIZED".

If the TSCTSF cannot successfully fulfil the received HTTP PUT request due to the internal TSCTSF error or due to the error in the HTTP PUT request, the TSCTSF shall send the HTTP error response as specified in clause 6.3.7.

If the TSCTSF determines the received HTTP PUT request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.4.2.4 Ntsctsf_ASTI_Delete

5.4.2.4.1 General

This service operation is used by an NF service consumer to delete a 5G access stratum time distribution configuration.

The following procedures using the Ntsctsf_ASTI_Delete service operation are supported:

- Delete an existing configuration.

5.4.2.4.2 Delete an existing configuration

Figure 5.4.2.4.2-1 illustrates the deleting of an existing configuration.

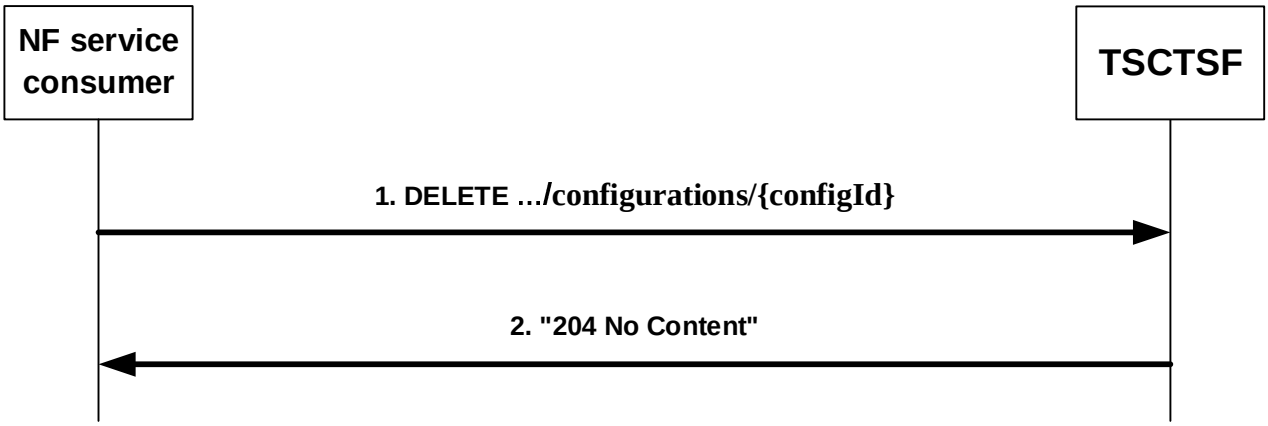

Figure 5.4.2.4.2-1: Deletion of a configuration

To delete a configuration or unsubscribe to 5G access stratum time distribution status, the NF service consumer shall send an HTTP DELETE request to the resource "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}" representing an existing "Individual ASTI Configuration" resource, as shown in figure 5.4.2.4.2-1, step 1, to delete the configuration/subscription.

Upon the reception of an HTTP DELETE request from the NF service consumer, if the HTTP DELETE request is authorized, the TSCTSF shall:

- interact with the PCF for a UE to remove the configuration information and, if applicable, subscription information in the PCF by using the Npcf_AMPolicyAuthorization_Delete service operation as defined in 3GPP TS 29.534 [14].
- remove the corresponding configuration and respond with "204 No Content" as shown in figure 5.4.2.4.2-1, step 2.

If the TSCTSF cannot successfully fulfil the received HTTP DELETE request due to the internal TSCTSF error or due to the error in the HTTP DELETE request, the TSCTSF shall send the HTTP error response as specified in clause 6.3.7.

If the TSCTSF determines the received HTTP DELETE request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.4.2.5 Ntsctsf_ASTI_Get

5.4.2.5.1 General

This service operation is used by an NF service consumer to retrieve ths status of the access stratum time distribution for a list of UEs.

The following procedures using the Ntsctsf_ASTI_Get service operation are supported:

- Retrieve the status of access stratum time distribution.

5.4.2.5.2 Retrieve the status of access stratum time distribution

Figure 5.4.2.5.2-1 illustrates the retrieval of the status of access stratum time distribution.

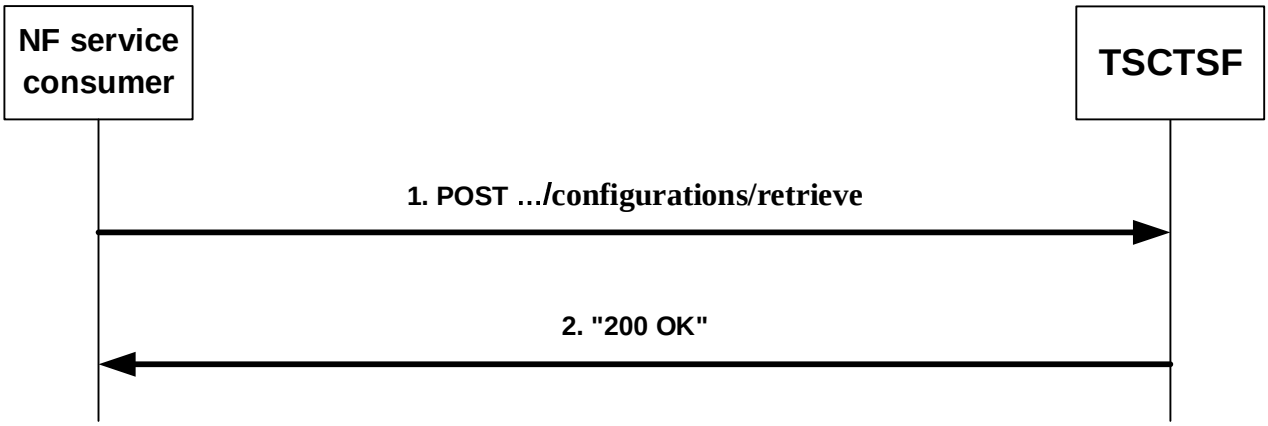

Figure 5.4.2.5.2-1: Retrieval of the status of access stratum time distribution

To retrieve the status of access stratum time distribution, the NF service consumer shall send an HTTP POST request to the resource "{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/retrieve". The HTTP POST message shall include the StatusRequestData data structure as request body, as shown in figure 5.4.2.5.2-1, step 1. The StatusRequestData data structure shall include:

- identification of a list of individual UEs within the "supis" attribute; or
- identification of a list of individual UEs within the "gpsis" attribute;

Upon the reception of an HTTP POST request and if the HTTP POST request is accepted by the TSCTSF, the TSCTSF determines the status of the access stratum time distribution is active for a UE if there is a 5G access stratum time distribution configuration applicable to the UE, i.e., it applies according to the temporal validity, if present, and the access time distribution via Uu reference point is activated; otherwise, the status of the access stratum time distribution is inactive for the UE.

The TSCTSF shall send an HTTP "200 OK" response with the StatusResponseData data structure as response body, as shown in figure 5.4.2.5.2-1, step 2 to notify of the status.

Within the StatusResponseData data structure, TSCTSF may include:

- a list of SUPI(s) whose status of the access stratum time distribution is inactive within the "inactiveUes" attribute or a list of GPSI(s) whose status of the access stratum time distribution is inactive within the "inactiveGpsis" attribute;
- the "activeUes" attribute containing one or more the ActiveUe instances which includes the UE identifier whose status of the access stratum time distribution is active within the "supi" attribute or "gpsi" attribute and the requested time synchronization error budget, if available, within the "timeSyncErrBdgt" attribute.

If the TSCTSF cannot successfully fulfil the received HTTP POST request due to the internal TSCTSF error or due to the error in the HTTP POST request, the TSCTSF shall send the HTTP error response as specified in clause 6.3.7.

If the TSCTSF determines the received HTTP POST request needs to be redirected, the TSCTSF shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.4.2.6 Ntsctsf_ASTI_UpdateNotify

5.4.2.6.1 General

This service operation is used by the TSCTSF to report about the change of state of the 5G access stratum time distribution configuration and the 5G access stratum time distribution status information.

The following procedures using the Ntsctsf_ASTI_UpdateNotify service operation are supported:

- Notification about the 5G Access Stratum Time Distribution events
- Notification about ASTI configuration changes due to UE presence in time synchronization coverage area.

- Notification about the 5G access stratum time distribution status information.

5.4.2.6.2 Notification about the 5G access stratum time distribution events

Figure 5.4.2.6.2-1 illustrates the notification about the 5G access stratum time distribution events.

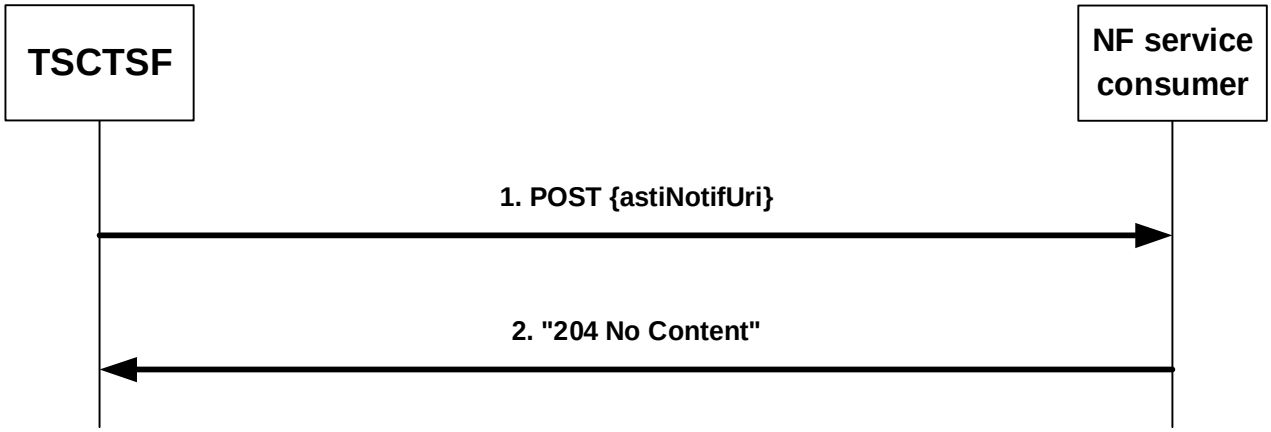

Figure 5.4.2.6.2-1: Notification about the 5G access stratum time distribution event

When the "ASTIConfigReport" feature is supported, the TSCTSF shall invoke the Ntsctsf_ASTI_UpdateNotify to report a 5G access stratum time distribution event by sending an HTTP POST request (as shown in figure 5.4.2.6.2-1, step 1) to the NF service consumer using as request URI the notification URI received in the creation (as specified in clause 5.4.2.2.2) or modification (as specified in clause 5.4.2.3.2) of the Individual ASTI Configuration resource, and the AstiConfigNotification data structure as request body.

The AstiConfigNotification data structure shall include:

- the notification correlation ID provided by the NF service consumer during the provisioning of 5G access stratum time distribution configuration within the "astiNotifId" attribute;
- the update of the 5G access stratum configuration for the indicated UE(s) within the "stateConfigs" attribute. Within each entry of the "stateConfigs" attribute, the TSCTSF shall include:
  a. the identification of the individual UE within either the "supi" or the "gpsi" attribute;
  b. information about the observed event within the "event" attribute. For each reported event, the additional event information, if applicable.

The notification of specific events using the Ntsctsf_ASTI_UpdateNotify service operation is described in the related clauses.

If the HTTP POST request from the TSCTSF is not accepted, the NF service consumer shall indicate in the response to HTTP POST request the cause for the rejection as specified in clause 6.3.7.

If the HTTP POST request from the TSCTSF is accepted, the NF service consumer shall acknowledge the receipt of the event notification with a "204 No Content" response, as shown in figure 5.4.2.6.2-1, step 2.

If the NF service consumer determines the received HTTP POST request needs to be redirected, the NF service consumer shall send an HTTP redirect response as specified in clause 6.10.9 of 3GPP TS 29.500 [4].

5.4.2.6.3 Notification about ASTI configuration changes due to UE presence in time synchronization coverage area

If the feature "CoverageAreaSupport" is supported and the TSCTSF received time synchronization coverage area as part of the Ntsctsf_ASTI_Create/Update service operation as described in clauses 5.4.2.2.2 and 5.4.2.3.2, when the TSCTSF receives a change in the UE presence in Area of Interest notification as described in 3GPP TS 29.518 [27], the TSCTSF shall determine if the re-evaluation of the time synchronization coverage area shall trigger an activation or deactivation of the access stratum time distribution:

- If the notification of change of UE presence in Area of Interest indicates that the UE is within any TAs from the time synchronization coverage area, then the TSCTSF shall enable access stratum time distribution for the UE. The TSCTSF shall provide the 5G access stratum time distribution configuration to the UE using the Npcf_AMPolicyAuthorization_Create service operation as defined in 3GPP TS 29.534 [14].

- If the notification of change of UE presence in Area of Interest indicates that the UE is not within any TAs from the time synchronization coverage area, then the TSCTSF shall disable access stratum time distribution for the UE. The TSCTSF shall disable the 5G access stratum time distribution to the UE using the Npcf_AMPolicyAuthorization_Update service operation as defined in 3GPP TS 29.534 [14].

If the feature "ASTIConfigReport" is supported, the TSCTSF shall invoke the Ntsctsf_ASTI_UpdateNotify to report the change of 5G access stratum time distribution configuration as specified in clause 5.4.2.6.2. The "stateConfigs" attribute shall include:

a. the "event" attribute set to "ASTI_ENABLED" to indicate the 5G access stratum time distribution configuration for the UE is active; or

b. the "event" attribute set to "ASTI_DISABLED" to indicate the 5G access stratum time distribution configuration for the UE is inactive.

The NF service consumer shall acknowledge or redirect the request as described in clause 5.4.2.6.2.

5.4.2.6.4 Notification about the 5G access stratum time distribution status information

If the "NetTimeSyncStatus" feature is supported and the TSCTSF received clock quality acceptance criteria as part of the Ntsctsf_ASTI_Create/Update service operation as described in clauses 5.4.2.2.2 and 5.4.2.3.2, when the TSCTSF is aware of 5G access stratum time distribution status information, the TSCTSF shall determine if the UE is impacted or not based on the UE presence in Area of Interest notification as described in clause 4.15.9.5.1 of 3GPP TS 23.502 [3].

If the "NetTimeSyncStatus" feature is supported and for the affected UEs, the TSCTSF shall invoke the Ntsctsf_ASTI_UpdateNotify to report about the 5G access stratum time distribution status as specified in clause 5.4.2.6.2 and shall include the status of the access stratum time distribution for the targeted UE(s) within the "stateConfigs" attribute as follows:

a. the "event" attribute set to "CLOCK_QUAL_ACCEPTABLE" to indicate the clock quality for the ASTI service is fulfilling the clock quality acceptance criteria for the UE; or

b. the "event" attribute set to "CLOCK_QUAL_NON_ACCEPTABLE" to indicate the clock quality for the ASTI service is not fulfilling the clock quality acceptance criteria for the UE. Based on this notification, the AF decides whether to modify the ASTI service configured for the UE using the Ntsctsf_ASTI_Update service as described in clause 5.4.2.3.

The NF service consumer shall acknowledge or redirect the request as described in clause 5.4.2.6.2.

6 API Definitions

6.1 Ntsctsf_TimeSynchronization Service API

6.1.1 Introduction

The Ntsctsf_TimeSynchronization service shall use the Ntsctsf_TimeSynchronization API.

The API URI of the Ntsctsf_TimeSynchronization API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "ntsctsf-time-sync".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.1.3.

6.1.2 Usage of HTTP

6.1.2.1 General

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Ntsctsf_TimeSynchronization API is contained in Annex A.2.

6.1.2.2 HTTP standard headers

6.1.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

6.1.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 9457 [13].

6.1.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

In this Release of the specification, no specific custom headers are defined for the Ntsctsf_TimeSynchronization API.

6.1.3 Resources

6.1.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.1.3.1-1 depicts the resource URIs structure for the Ntsctsf_TimeSynchronization API.

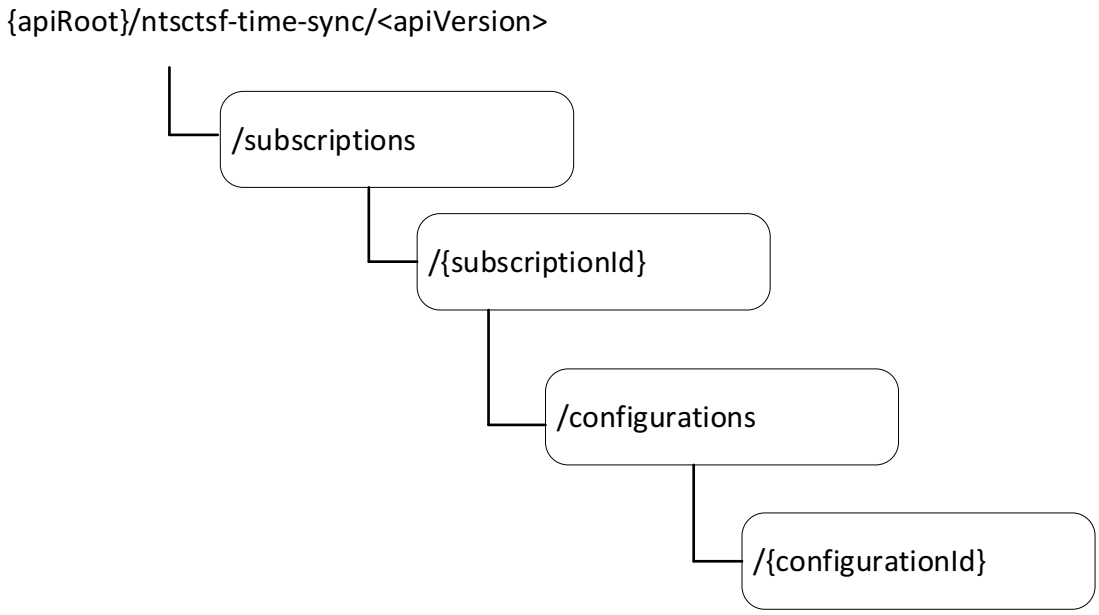

Figure 6.1.3.1-1: Resource URI structure of the Ntsctsf_TimeSynchronization API

Table 6.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.1.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
Time Synchronization Exposure	/subscriptions	POST	Create a new subscription to notification of capability of time synchronization service.
Individual Time Synchronization Exposure Subscription	/subscriptions/{subscriptionId}	GET	Read a subscription to notification of capability of time synchronization service.
		PUT	Modify a subscription to notification of capability of time synchronization service.
		DELETE	Delete a subscription to notification of capability of time synchronization service.
Time Synchronization Exposure Configurations	/subscriptions/{subscriptionId}/configurations	POST	Create a new configuration to time synchronization exposure.
Individual Time Synchronization Exposure Configuration	/subscriptions/{subscriptionId}/configurations/{configurationId}	GET	Read a configuration to time synchronization exposure.
		PUT	Modify all of the properties of an existing configuration to time synchronization exposure.
		DELETE	Delete a configuration to time synchronization exposure.

6.1.3.2 Resource: Time Synchronization Exposure Subscriptions

6.1.3.2.1 Description

This resource allows a NF service consumer to create a new subscription to notification of the capability for time synchronization service.

6.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions**

This resource shall support the resource URI variables defined in table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.1

6.1.3.2.3 Resource Standard Methods

6.1.3.2.3.1 POST

The POST method creates a new subscription resource to time synchronization exposure subscription. The NF service consumer shall initiate the HTTP POST request message and the TSCTSF shall respond to the message. The TSCTSF shall construct the URI of the created resource.

This method shall support the URI query parameters specified in table 6.1.3.2.3.1-1.

Table 6.1.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.2.3.1-2 and the response data structures and response codes specified in table 6.1.3.2.3.1-3.

Table 6.1.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
TimeSyncExposureSubsc	M	1	Parameters to request a subscription to notification of the capability for time synchronization service.

Table 6.1.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TimeSyncExposureSubsc	M	1	201 Created	The subscription was created successfully. The URI of the created resource shall be returned in the "Location" HTTP header.
ProblemDetails	O	0..1	403 Forbidden	(NOTE 2)
NOTE 1: The manadatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: Failure causes are described in clause 6.1.7.				

Table 6.1.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-time-sync/<apiVersion>/ subscriptions/{subscriptionId}

6.1.3.2.4 Resource Custom Operations

None.

6.1.3.3 Resource: Individual Time Synchronization Exposure Subscription

6.1.3.3.1 Description

This resource allows a NF service consumer to read, modify or delete an existing subscription to notification of the capability for time synchronization service.

6.1.3.3.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}**

This resource shall support the resource URI variables defined in table 6.1.3.3.2-1.

Table 6.1.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.1
subscriptionId	string	Represents a specific subscription. It is the identifier of the Individual Time Synchronization Exposure Subscription resource.

6.1.3.3.3 Resource Standard Methods

6.1.3.3.3.1 GET

This method shall support the URI query parameters specified in table 6.1.3.3.3.1-1.

Table 6.1.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.3.3.1-2 and the response data structures and response codes specified in table 6.1.3.3.3.1-3.

Table 6.1.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TimeSyncExposureSubsc	M	1	200 OK	An Individual Time Synchronization Exposure Subscription resource is returned successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during an Individual Time Synchronization Exposure Subscription resource retrieval. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during an Individual Time Synchronization Exposure Subscription resource retrieval. (NOTE 2)
NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.1.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.1.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.1.3.3.3.2 DELETE

This method shall support the URI query parameters specified in table 6.1.3.3.3.2-1.

Table 6.1.3.3.3.2-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.3.3.2-2 and the response data structures and response codes specified in table 6.1.3.3.3.2-3.

Table 6.1.3.3.3.2-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The subscription was deleted successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual Time Synchronization Exposure Subscription resource deletion. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual Time Synchronization Exposure Subscription resource deletion. (NOTE 2)
NOTE 1: The manadatory HTTP error status code for the DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.1.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.1.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.1.3.3.3 PUT

This method shall support the URI query parameters specified in table 6.1.3.3.3-1.

Table 6.1.3.3.3-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.3.3.3-2 and the response data structures and response codes specified in table 6.1.3.3.3.3-3.

Table 6.1.3.3.3.3-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
TimeSyncExposureSubsc	M	1	Modify an existing Time Synchronization Exposure Subscription.

Table 6.1.3.3.3.3-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TimeSyncExposureSubsc	M	1	200 OK	The subscription was updated successfully.
n/a			204 No Content	The subscription was updated successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual Time Synchronization Exposure Subscription resource modification. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual Time Synchronization Exposure Subscription resource modification. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The manadatory HTTP error status code for the PUT method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure causes are described in clause 6.1.7.				

Table 6.1.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.1.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.1.3.3.4 Resource Custom Operations

None.

6.1.3.4 Resource: Time Synchronization Exposure Configurations

6.1.3.4.1 Description

This resource allows a NF service consumer to create a new subscription to notification of the capability for time synchronization service.

6.1.3.4.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations**

This resource shall support the resource URI variables defined in table 6.1.3.4.2-1.

Table 6.1.3.4.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.1
subscriptionId	string	Represents a specific subscription. It is the identifier of the Individual Time Synchronization Exposure Subscription resource.

6.1.3.4.3 Resource Standard Methods

6.1.3.4.3.1 POST

The POST method creates a new configuration resource to activate time synchronization service. The NF service consumer shall initiate the HTTP POST request message and the TSCTSF shall respond to the message. The TSCTSF shall construct the URI of the created resource.

This method shall support the URI query parameters specified in table 6.1.3.4.3.1-1.

Table 6.1.3.4.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.4.3.1-2 and the response data structures and response codes specified in table 6.1.3.4.3.1-3.

Table 6.1.3.4.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
TimeSyncExposureConfig	M	1	Parameters to create a configuration to activate time synchronization service.

Table 6.1.3.4.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TimeSyncExposureConfig	M	1	201 Created	The configuration was created successfully. The URI of the created resource shall be returned in the "Location" HTTP header.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual Time Synchronization Exposure Configuration resource creation. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual Time Synchronization Exposure Configuration resource creation. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The manadatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.1.7.				

Table 6.1.3.4.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configuration/{configurationId}

Table 6.1.3.4.3.1-5: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.1.3.4.3.1-6: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.1.3.4.4 Resource Custom Operations

None.

6.1.3.5 Resource: Individual Time Synchronization Exposure Configuration

6.1.3.5.1 Description

This resource allows a NF service consumer to modify/cancel a configuration to modify/deactivate Time Synchronization service with the TSCTSF

6.1.3.5.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}/configurations/{configurationId}**

This resource shall support the resource URI variables defined in table 6.1.3.5.2-1.

Table 6.1.3.5.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.1
subscriptionId	string	Represents a specific subscription. It is the identifier of the Individual Time Synchronization Exposure Subscription resource.
configurationId	string	Represents a specific configuration. It is the identifier of the Individual Time Synchronization Exposure Configuration resource.

6.1.3.5.3 Resource Standard Methods

6.1.3.5.3.1 GET

This method shall support the URI query parameters specified in table 6.1.3.5.3.1-1.

Table 6.1.3.5.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.5.3.1-2 and the response data structures and response codes specified in table 6.1.3.5.3.1-3.

Table 6.1.3.5.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.5.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TimeSyncExposureConfig	M	1	200 OK	The configuration information in the request URI are returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual Time Synchronization Exposure Configuration resource retrieval. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual Time Synchronization Exposure Configuration resource retrieval. (NOTE 2)
NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.1.3.4.3.1-5: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.1.3.4.3.1-6: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.1.3.5.3.2 PUT

This method shall support the URI query parameters specified in table 6.1.3.5.3.2-1.

Table 6.1.3.5.3.2-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.5.3.2-2 and the response data structures and response codes specified in table 6.1.3.5.3.2-3.

Table 6.1.3.5.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
TimeSyncExposureConfig	M	1	Modify an existing Time Synchronization Exposure Configuration.

Table 6.1.3.5.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TimeSyncExposureConfig	M	1	200 OK	The subscription was updated successfully.
n/a			204 No Content	The subscription was updated successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual Time Synchronization Exposure Configuration resource update. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual Time Synchronization Exposure Configuration resource update. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.1.7.				

Table 6.1.3.5.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.1.3.5.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.1.3.5.3.3 DELETE

This method shall support the URI query parameters specified in table 6.1.3.5.3.3-1.

Table 6.1.3.5.3.3-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.1.3.5.3.3-2 and the response data structures and response codes specified in table 6.1.3.5.3.3-3.

Table 6.1.3.5.3.3-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.5.3.3-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The configuration was deleted successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during Individual Time Synchronization Exposure Configuration resource deletion. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during Individual Time Synchronization Exposure Configuration resource deletion (NOTE 2)
NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.1.3.5.3.3-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.1.3.5.3.3-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.1.3.5.4 Resource Custom Operations

None.

6.1.4 Custom Operations without associated resources

Void

6.1.5 Notifications

6.1.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 6.1.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Time Synchronization Capability Notification	{subsNotifUri}	POST	Time Synchronization Capability Notification for a list of UEs.
Time Synchronization Configuration Notification	{configNotifUri}	POST	Current state of Time Synchronization Service configuration Notification.

6.1.5.2 Time Synchronization Capability Notification

6.1.5.2.1 Description

The Time Synchronization Capability Notification is used by the NF service producer to report the capability of the time synchronization service for a list of UEs to a NF service consumer that has subscribed to such Notifications.

6.1.5.2.2 Target URI

The Callback URI **"{subsNotifUri}"** shall be used with the callback URI variables defined in table 6.1.5.2.2-1.

Table 6.1.5.2.2-1: Callback URI variables

Name	Definition
subsNotifUri	String formatted as URI with the Callback Uri. The Callback Uri is assigned within the Time Synchronization Capability Notification and described within the TimeSyncExposureSubsc type (see table 6.1.6.2.2-1).

6.1.5.2.3 Standard Methods

6.1.5.2.3.1 POST

This method shall support the request data structures specified in table 6.1.5.2.3.1-1 and the response data structures and response codes specified in table 6.1.5.2.3.1-2

Table 6.1.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
TimeSyncExposureSubsNotif	M	1	Provides the time synchronization capabilities of a list of UEs by the TSCTSF to the NF service consumer.

Table 6.1.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The event notification is received successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during event notification. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during event notification. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.1.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

Table 6.1.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

6.1.5.3 Time Synchronization Configuration Notification

6.1.5.3.1 Description

The Time Synchronization Configuration Notification is used by the NF service producer to report the current state of configuration of the time synchronization service.

6.1.5.3.2 Target URI

The Callback URI **"{configNotifUri}"** shall be used with the callback URI variables defined in table 6.1.5.3.2-1.

Table 6.1.5.3.2-1: Callback URI variables

Name	Definition
configNotifUri	String formatted as URI with the Callback Uri. The Callback Uri is assigned within the Time Synchronization Configuration Notification and described within the TimeSyncExposureConfig type (see table 6.1.6.2.9-1).

6.1.5.3.3 Standard Methods

6.1.5.3.3.1 POST

This method shall support the request data structures specified in table 6.1.5.3.3.1-1 and the response data structures and response codes specified in table 6.1.5.3.3.1-2.

Table 6.1.5.3.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
TimeSyncExposureConfigNotif	M	1	Provides the current state of time synchronization configuration by the TSCTSF to the NF service consumer.

Table 6.1.5.3.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The event notification is received successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during event notification. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during event notification. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.1.5.3.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

Table 6.1.5.3.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected.

6.1.6 Data Model

6.1.6.1 General

This clause specifies the application data model supported by the API.

Table 6.1.6.1-1 specifies the data types defined for the Ntsctsf_TimeSynchronization service based interface protocol.

Table 6.1.6.1-1: Ntsctsf_TimeSynchronization specific Data Types

Data type	Clause defined	Description	Applicability
ConfigForPort	6.1.6.2.11	Contains the configuration for a port.	
PtpCapabilitiesPerUe	6.1.6.2.6	Contains the PTP capabilities supported by a UE.	
PtpInstance	6.1.6.2.10	Contains the PTP Instance.	
StateOfConfiguration	6.1.6.2.8	Indicates the PTP port states for a NW-TT and DS-TTs.	
StateOfDstt	6.1.6.2.12	Contains the PTP port state of a DS-TT	
SubsEventNotification	6.1.6.2.4	Contains the notification of capability of time synchronization for a list of UEs.	
TimeSyncCapability	6.1.6.2.5	Contains the capability of time synchronization service	
TimeSyncExposureConfig	6.1.6.2.9	Contains the configuration of time synchronization service	
TimeSyncExposureConfigNotif	6.1.6.2.7	Contains the notification of configuration of time synchronization service.	
TimeSyncExposureSubsc	6.1.6.2.2	Contains the parameters for the subscription to notification of capability of time synchronization service	
TimeSyncExposureSubsNotif	6.1.6.2.3	Contains the notification of time synchronization service.	

Table 6.1.6.1-2 specifies data types re-used by the Ntsctsf_TimeSynchronization service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Ntsctsf_TimeSynchronization service based interface.

Table 6.1.6.1-2: Ntsctsf_TimeSynchronization re-used Data Types

Data type	Reference	Comments	Applicability
AcceptanceCriteriaResultIndication	3GPP TS 29.522 [17]	Contains the acceptable/not acceptable indication of the clock quality acceptance criteria result information.	NetTimeSyncStatus
AsTimeResource	3GPP TS 29.522 [17]	Indicates the supported 5G clock quality.	
ClockQualityAcceptanceCriterion	3GPP TS 29.571 [15]	Identifies clock quality acceptance criteria information.	NetTimeSyncStatus
ClockQualityDetailLevel	3GPP TS 29.571 [15]	Identifies clock quality detail level information.	NetTimeSyncStatus
DateTime	3GPP TS 29.571 [15]	String with format "date-time" as defined in OpenAPI Specification [6].	
Dnn	3GPP TS 29.571 [15]	The DNN the user is connected to.	
DurationSec	3GPP TS 29.571 [15]	Identifies a period of time in units of seconds.	
EventFilter	3GPP TS 29.522 [17]	Contains the conditions to match for notifying the event(s) of time synchronization capabilities.	
ExternalGroupId	3GPP TS 29.571 [15]	Identifies a External Group.	
GmCapable	3GPP TS 29.522 [17]	Indicates separately whether 5GS supports acting as a gPTP or PTP grandmaster.	
Gpsi	3GPP TS 29.571 [15]	The external identification of the user (i.e., an External Id or an MSISDN).	
GroupId	3GPP TS 29.571 [15]	Identifies a group of internal globally unique ID.	
NotificationMethod	3GPP TS 29.508 [16]	Identifies the notification method.	
InstanceType	3GPP TS 29.522 [17]	Identifies supported PTP instance type.	
ProblemDetails	3GPP TS 29.571 [15]	Problem Details when returning an error response.	
Protocol	3GPP TS 29.522 [17]	Identifies the supported protocol in a PTP instance.	
RedirectResponse	3GPP TS 29.571 [15]	Contains redirection related information.	
ReportedCapability	3GPP TS 29.522 [17]	Contains the reported time synchronization capabilities for a UE/DS-TT.	SupportReport
ServiceAreaCoverageInfo	3GPP TS 29.534 [14]	It represents a list of Tracking Areas within a serving network.	CoverageAreaSupport
Snssai	3GPP TS 29.571 [15]	Identifies the S-NSSAI.	
SubscribedEvent	3GPP TS 29.522 [17]	Indicates the subscribed event.	
Supi	3GPP TS 29.571 [15]	The identification of the user (i.e. IMSI, NAI).	
SupportedFeatures	3GPP TS 29.571 [15]	Used to negotiate the applicability of the optional features defined in table 5.8-1.	
TimeSyncExposureConfig	3GPP TS 29.522 [17]	Contains the parameters of time synchronization configuration.	
Uinteger	3GPP TS 29.571 [15]	Unsigned integer.	
Uint64	3GPP TS 29.571 [15]		
Uri	3GPP TS 29.571 [15]	Identifies a referenced resource.	

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

6.1.6.2.2 Type: TimeSyncExposureSubsc

Table 6.1.6.2.2-1: Definition of type TimeSyncExposureSubsc

Attribute name	Data type	P	Cardinality	Description	Applicability
supis	array(Supi)	C	1..N	Subscription Permanent Identifier. (NOTE)	
gpsis	array(Gpsi)	C	1..N	Public user identifier. (NOTE)	
interGrpId	GroupId	C	0..1	The internal Group Id. (NOTE)	
exterGrpId	ExternalGroupId	C	0..1	The external Group Id. (NOTE)	
anyUeInd	boolean	C	0..1	Identifies whether the AF request applies to any UE (i.e. all UEs). This attribute shall set to "true" if applicable for any UE, otherwise, set to "false". (NOTE)	
notifMethod	NotificationMethod	O	0..1	If "notifMethod" is not supplied, the default value "ON_EVENT_DETECTION" applies.	
dnn	Dnn	M	1	Identifies a DNN, a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only.	
snssai	Snssai	M	1	Identifies an S-NSSAI.	
subscribedEvents	array(SubscribedEvent)	M	1..N	Identifies the requirement to be notified of the event(s).	
eventFilters	array(EventFilter)	O	1..N	Contains the filter conditions to match for notifying the event(s) of time synchronization capabilities for a list of UE(s).	
subsNotifUri	Uri	M	1	Notification URI for time sensitive capability reporting.	
subsNotifId	string	M	1	Notification Correlation ID assigned by the NF service consumer.	
maxReportNbr	Uinteger	O	0..1	If omitted, there is no limit.	
expiry	DateTime	C	0..1	This attribute indicates the expiry time of the subscription, after which the NEF shall not send any event notifications and the subscription becomes invalid. It may be included in an event subscription request and may be included in an event subscription response based on operator policies. If an expiry time was included in the request, then the expiry time returned in the response should be less than or equal to that value. If the expiry time is not included in the response, the NF service consumer shall not associate an expiry time for the subscription.	
repPeriod	DurationSec	C	0..1	Is supplied for notification Method "periodic".	

suppFeat	SupportedFeatures	C	0..1	Represents the features supported by the NF service consumer. This parameter shall be supplied by the NF service consumer in the POST request and the response that requested the creation of an Individual Time Synchronization Subscription resource.	
NOTE: Only one of the properties "supis", "gpsis", "anyUeInd", "exterGrpId" or "interGrpId" shall be included.					

6.1.6.2.3 Type: TimeSyncExposureSubsNotif

Table 6.1.6.2.3-1: Definition of type TimeSyncExposureSubsNotify

Attribute name	Data type	P	Cardinality	Description	Applicability
subsNotifId	string	M	1	Notification Correlation ID assigned by the NF service consumer.	
eventNotifs	array(SubsEventNotification)	M	1..N	Notifications about Individual Events	

6.1.6.2.4 Type SubsEventNotification

Table 6.1.6.2.4-1: Definition of type SubsEventNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
event	SubscribedEvent	M	1	Subscribed events	
timeSyncCapas	array(TimeSyncCapability)	C	1..N	Contains a list of time syncroniziation capabilities for the 5GS (list of User-Plane Node IDs) and the UE(s) (per User Plane Node Id). It shall be provided if the reported event is "AVAILABILITY_FOR_TIME_SYNC_SERVICE".	

6.1.6.2.5 Type: TimeSyncCapability

Table 6.1.6.2.5-1: Definition of type TimeSyncCapability

Attribute name	Data type	P	Cardinality	Description	Applicability
upNodeId	Uint64	M	1	Identifies the applicable NW-TT. Contains a TSC user plane node Id. If integrated with TSN, the user plane node Id is a bridge Id defined in IEEE Std 802.1Q-2018 [18] clause 14.2.5.	
gmCapables	array(GmCapable)	C	1..N	Indicates whether user plane node supports acting as a gPTP and/or PTP grandmaster. (NOTE 1)	
asTimeRes	AsTimeResource	C	0..1	Indicates the supported 5G clock quality (i.e. the source of time used by the 5GS). (NOTE 1)	
ptpCapForUes	map(PtpCapabilitiesPerUe)	C	1..N	Contains the PTP capabilities supported by the list of UE(s). The key of the map is the SUPI. Shall be present if the "gmCapables" attribute is included and the PTP Capabilities are reported per SUPI. (NOTE 2)	
ptpCapForGpsis	map(PtpCapabilitiesPerUe)	C	1..N	Contains the PTP capabilities supported by the list of UE(s). The key of the map is the GPSI. Shall be present if the "gmCapables" attribute is included and the PTP Capabilities are reported per GPSI. (NOTE 2)	

NOTE 1: At least one of the "gmCapables" attribute and "asTimeRes" attribute shall be included.
NOTE 2: The "PtpCapabilitiesPerUe" entry shall contain the PTP capabilities for previously targeted UE(s) for which the PTP capabilities changed and/or the PTP capabilities for new UE(s).

6.1.6.2.6 Type: PtpCapabilitiesPerUe

Table 6.1.6.2.6: Definition of type PtpCapabilitiesPerUe

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	C	0..1	Identifies the UE to which the reported PTP instance below apply. (NOTE 1)	
gpsi	Gpsi	C	0..1	Identifies the UE to which the reported PTP instance below apply. (NOTE 1)	
ptpCaps	array(ReportedCapability)	M	1..N	Contains the reported PTP capabilities for the UE. (NOTE 2)	

NOTE 1: Either the "supi" or the "gpsi" attribute is included, based on whether the request contained an internal or an external identifier.
NOTE 2: When the "SupportReport" feature is supported, indicates the PTP capabilities of the UE changed because of the termination of the PDU session, the "ptpCaps" attribute shall contain a ReportedCapability entry with the "avStatus" attribute set to "PDU_SESSION_TERMINATION".

6.1.6.2.7 Type: TimeSyncExposureConfigNotif

Table 6.1.6.2.7-1: Definition of type TimeSyncExposureConfigNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
configNotifId	string	M	1	Notification Correlation ID assigned by the NF service consumer.	
stateOfConfig	StateOfConfiguration	M	1	Indicates the current state of time synchroniztion service configuration	

6.1.6.2.8 Type: StateOfConfiguration

Table 6.1.6.2.8-1: Definition of type StateOfConfiguration

Attribute name	Data type	P	Cardinality	Description	Applicability
stateNwtt	boolean	O	0..1	When any of the PTP port state(s) in NW-TT is Leader, Follower or Passive, it is included and set to true to indicate the current state of the time synchronization configuration for the NW-TT port(s) of the PTP instance is active; when PTP port state is in any other case, it is included and set to false to indicate the state of configuration for the NW-TT port(s) of the PTP instance is inactive. Default value is false.	
clkQltIndOfNwtt	AcceptanceCriteriaResultIndication	O	0..1	Indicates the clock quality acceptance criteria changes ("ACCEPTABLE", "NOT_ACCEPTABLE") for any of the PTP port(s) in the NW-TT of the PTP instance.	NetTimeSyncStatus
stateOfDstts	array(StateOfDstt)	O	1..N	Contains the PTP port states and the clock quality acceptance criteria result of the DS-TT(s).	

6.1.6.2.9 Type: TimeSyncExposureConfig

Table 6.1.6.2.9-1: Definition of type TimeSyncExposureConfig

Attribute name	Data type	P	Cardinality	Description	Applicability
upNodeId	Uint64	M	1	Identifies the applicable NW-TT. Contains a TSC user plane node Id. If integrated with TSN, the user plane node Id is a bridge Id defined in IEEE 802.1Q [41] clause 14.2.5.	
reqPtpIns	PtpInstance	M	1	Identifies the PtP instance configuration and activation requested by the AF.	
gmEnable	boolean	O	0..1	Indicates that the AF requests 5GS to act as a grandmaster for PTP or gPTP if it is included and set to true. The default value "false" shall apply, if the attribute is not present.	
gmPrio	Uinteger	O	0..1	Indicates a priority used as defaultDS.priority1 when generating Announce message when 5GS acts as (g)PTP GM. It may be present if the "gmEnable" is set to true.	
timeDom	Uinteger	M	1	Indicate the (g)PTP domain that the (TSN)AF is located in.	
timeSyncErrBdgt	Uinteger	O	0..1	Indicates the time synchronization budget for the time synchronization service in units of nanoseconds. Minimum = 1.	
tempValidity	TemporalValidity	O	0..1	Indicates the time period when the time synchronization service for a PTP instance is active.	
configNotifUri	Uri	M	1	Notification URI for configuration state reporting.	
configNotifId	string	M	1	Notification Correlation ID assigned by the NF service consumer.	
covReq	array(ServiceAreaCoverageInfo)	O	1..N	Identifies a list of Tracking Areas per serving network where the time synchronization service configuration is allowed.	CoverageAreaSupport
clkQltDetLvl	ClockQualityDetailLevel	O	0..1	Indicates the clock quality detail level. For (g)PTP services, its value, if provided, shall be set to "ACCEPT_INDICATION".	NetTimeSyncStatus
clkQltAcptCri	ClockQualityAcceptanceCriterion	C	0..1	Indicates the clock quality acceptance criteria, and it is used to determine whether the time synchronization status for the (g)PTP service is acceptable/not acceptable. It shall be present when the "clkQltDetLvl" attribute is present.	NetTimeSyncStatus

6.1.6.2.10 Type: PtpInstance

Table 6.1.6.2.10-1: Definition of type PtpInstance

Attribute name	Data type	P	Cardinality	Description	Applicability
instanceType	InstanceType	M	1	Indicates the PTP instance type.	
protocol	Protocol	M	1	Indicates the protocol type.	
ptpProfile	string	M	1	Identifies the PTP profile.	
portConfigs	array(ConfigForPort)	O	1..N	Contains the configurations for the PTP port(s) in the PTP instance.	

6.1.6.2.11 Type: ConfigForPort

Table 6.1.6.2.11-1: Definition of type ConfigForPort

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	C	0..1	Identifies the UE/DS-TT to which the provided configuration parameters apply. (NOTE)	
gpsi	Gpsi	C	0..1	Identifies the UE/ DS-TT to which the provided configuration parameters apply. (NOTE)	
n6Ind	boolean	C	0..1	Indicates whether the provided configurationparameters apply to the N6 interface. - "true" indicates that the below configuration parameters apply to the N6 interface. Presence of this attribute with the value "false" shall be prohibited. (NOTE)	
ptpEnable	boolean	O	0..1	Indicates howto set the portDS.portEnable (see IEEE Std 1588-2019 [25]). - "true" indicates to set the portDS.portEnable to TRUE. - "false" indicates to set the portDS.portEnable to FALSE. - If omitted, the default value as described in the PTP Profile is used.	
logSyncInter	integer	O	0..1	Specifies the mean time interval between successive Sync messages. This is applicable for IEEE Std 1588-2019 [25] Boundary Clock or IEEE Std 802.1AS-2020 [26] operation. If omitted, the default value as described in the PTP Profile is used.	

logSyncInterInd	boolean	O	0..1	Indicates how the value of the "logSyncInter" attribute is to be used. - When set to "false", the value of "logSyncInter" attribute is used to set the initialLogSyncInterval as described in IEEE Std 802.1AS-2020 [26]. - When set to "true", the value of "logSyncInter" attribute is used to set the mgtSettableLogSyncInterval as described in IEEE Std 802.1AS-2020 [26]. - If omitted, the default value as described in the IEEE Std 802.1AS-2020 [26] is used.	
logAnnouInter	integer	O	0..1	Specifies the mean time interval between successive Announce messages. This is applicable for IEEE Std 1588-2019 [25] Boundary Clock or IEEE Std 802.1AS-2020 [26] operation. If omitted, the default value as described in the PTP Profile is used.	
logAnnouInterInd	boolean	O	0..1	Indicates how the value of the "logAnnouInter" attribute is to be used. - When set to "false", the value of "logAnnouInter" attribute is used to set the initialLogAnnounceInterval as described in IEEE 802.1AS-2020 [26]. - When set to "true", the value of "logAnnouInter" attribute is used to set the mgtSettableLogAnnounceInterval as described in IEEE Std 802.1AS-2020 [26]. - If omitted, the default value as described in the IEEE Std 802.1AS-2020 [26] is used.	
NOTE: Only one of the "gpsi" attribute or the "n6Ind" attribute, or if the "TimeSyncExposureConfig_Corr" feature is supported, the "supi" attribute shall be present.					

6.1.6.2.12 Type: StateOfDstt

Table 6.1.6.2.12-1: Definition of type StateOfDstt

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	C	0..1	Identifies the UE/DS-TT which the parameters below apply. (NOTE)	
gpsi	Gpsi	C	0..1	Identifies the UE/DS-TT which the parameters below apply. (NOTE)	
state	boolean	M	1	When the PTP port state is Leader, Follower or Passive, it is included and set to true to indicate the current state of the time synchronization configuration for DS-TT port is active; when PTP port state is in any other case, it is included and set to false to indicate the state of configuration for DS-TT port is inactive. Default value is false.	
clkQltIndOfDstt	AcceptanceCriteriaResultIndication	O	0..1	Indicates the clock quality acceptance criteria changes ("ACCEPTABLE", "NOT_ACCEPTABLE") for the indicated DS-TT port of the PTP instance.	NetTimeSyncStatus
NOTE: Either the "supi" or the "gpsi" attribute is included, based on whether the request contained an internal or an external identifier					

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.1.6.3.2 Simple data types

The simple data types defined in table 6.1.6.3.2-1 shall be supported.

Table 6.1.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.1.7 Error Handling

6.1.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [5].

For the Ntsctsf_TimeSynchronization API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Ntsctsf_TimeSynchronization API.

6.1.7.2 Protocol Errors

No specific procedures for the Ntsctsf_TimeSynchronization service are specified.

6.1.7.3 Application Errors

The application errors defined for the Ntsctsf_TimeSynchronization service are listed in Table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

Application Error	HTTP status code	Description	Applicability
UE_SERVICE_NOT_AUTHORIZED	403 Forbidden	The AF request is not authorized, or the AF requested parameter(s) are not authorized by UE's Time Synchronization Data in UDM.	SupportReport

6.1.8 Feature negotiation

The optional features in table 6.1.8-1 are defined for the Ntsctsf_TimeSynchronization API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.8-1: Supported Features

Feature number	Feature Name	Description
1	CoverageAreaSupport	Indicates the support of spatial validity conditions for the activation/deactivation of the time synchronization service.
2	NetTimeSyncStatus	Indicates the time synchronization service status.
3	TimeSyncExposureConfig_Corr	Indicates the support of the correction in the OpenAPI to enable the creation of a Time Synch Exposure Configuration using the SUPI as DS-TT identifier.
4	SupportReport	This feature indicates the support of the report of whether the AF requested Time Synchronization is available and authorized for the requested UE's.

6.1.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Ntsctsf_TimeSynchronization API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Ntsctsf_TimeSynchronization API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Ntsctsf_TimeSynchronization service.

The Ntsctsf_TimeSynchronization API defines a single scope "ntsctsf-time-sync" for the entire service, and it does not define any additional scopes at resource or operation level.

6.2 Ntsctsf_QoSandTSCAssistance Service API

6.2.1 Introduction

The Ntsctsf_QoSandTSCAssistance service shall use the Ntsctsf_QoSandTSCAssistance API.

The API URI of the Ntsctsf_QoSandTSCAssistance API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [4], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "ntsctsf-qos-tscai".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.2.3.

6.2.2 Usage of HTTP

6.2.2.1 General

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Ntsctsf_QoSandTSCAssistance API is contained in Annex A.3.

6.2.2.2 HTTP standard headers

6.2.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

6.2.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

JSON object used in the HTTP PATCH request shall be encoded according to "JSON Merge Patch" and shall be signalled by the content type "application/merge-patch+json", as defined in IETF RFC 7396 [22].

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 9457 [13].

6.2.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

In this Release of the specification, no specific custom headers are defined for the Ntsctsf_QoSandTSCAssistance API.

6.2.3 Resources

6.2.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.2.3.1-1 depicts the resource URIs structure for the Ntsctsf_QoSandTSCAssistance API.

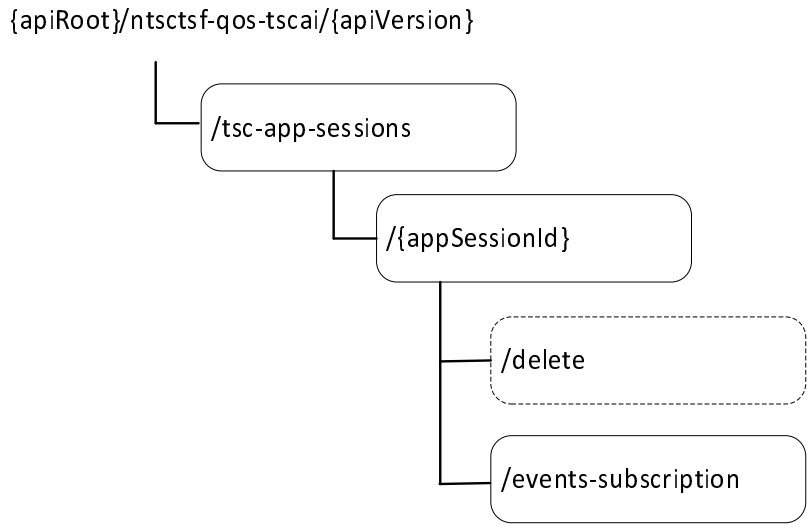

Figure 6.2.3.1-1: Resource URI structure of the Ntsctsf_QoSandTSCAssistance API

Table 6.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.2.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
TSC Application Sessions	/tsc-app-sessions	POST	Ntsctsf_QoSandTSCAssistance_Create. Creates a new Individual TSC Application Session Context resource and may create the child Events Subscription sub-resource.
Individual TSC Application Session Context	/tsc-app-sessions/{appSessionId}	PATCH	Ntsctsf_QoSandTSCAssistance_Update. Updates an existing Individual TSC Application Session Context resource. It can also update an Events Subscription sub-resource.
		GET	Reads an existing Individual TSC Application Session Context resource.
	/tsc-app-sessions/{appSessionId}/delete	delete (POST)	Ntsctsf_QoSandTSCAssistance_Delete. Deletes an existing Individual TSC Application Session Context resource and the child Events Subscription sub-resource.
Events Subscription	/tsc-app-sessions/{appSessionId} /events-subscription	PUT	Ntsctsf_QoSandTSCAssistance_Subscribe. Creates a new Events Subscription sub-resource or modifies an existing Events Subscription sub-resource.
		DELETE	Ntsctsf_QoSandTSCAssistance_Unsubscribe. Deletes an Events Subscription sub-resource.

6.2.3.2 Resource: TSC Application Sessions

6.2.3.2.1 Description

This resource allows a NF service consumer to create a new Individual TSC Application Session Context resource and may create the child Events Subscription sub-resource.

6.2.3.2.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions**

This resource shall support the resource URI variables defined in table 6.2.3.2.2-1.

Table 6.2.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.2.1

6.2.3.2.3 Resource Standard Methods

6.2.3.2.3.1 POST

This method shall support the URI query parameters specified in table 6.2.3.2.3.1-1.

Table 6.2.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.2.3.2.3.1-2 and the response data structures and response codes specified in table 6.2.3.2.3.1-3.

Table 6.2.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
TscAppSessionContextData	M	1	Contains the information for the creation of a new Individual TSC Application Session Context resource.

Table 6.2.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TscAppSessionContextData	M	1	201 Created	The subscription was created successfully. The URI of the created resource shall be returned in the "Location" HTTP header.
ProblemDetailsTsctsfQosTscac	O	0..1	403 Forbidden	(NOTE 2)
ProblemDetails	O	0..1	500 Internal Server Error	(NOTE 2)
NOTE 1: The manadatory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: Failure cases are described in clause 6.2.7.				

Table 6.2.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}

Table 6.2.3.2.3.1-5: Headers supported by the 403 Response Code on this resource

Name	Data type	P	Cardinality	Description
Retry-After	string	M	1	Indicates the time the NF service consumer has to wait before making a new request.

6.2.3.2.4 Resource Custom Operations

None.

6.2.3.3 Resource: Individual TSC Application Session Context

6.2.3.3.1 Description

This resource allows a NF service consumer to read, modify or delete an existing Individual TSC Application Session Context resource.

6.2.3.3.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}**

This resource shall support the resource URI variables defined in table 6.2.3.3.2-1.

Table 6.2.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.2.1
appSessionId	string	Identifier of an Individual TSC Application Session Context resource

6.2.3.3.3 Resource Standard Methods

6.2.3.3.3.1 GET

This method shall support the URI query parameters specified in table 6.2.3.3.3.1-1.

Table 6.2.3.3.3.1-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.2.3.3.3.1-2 and the response data structures and response codes specified in table 6.2.3.3.3.1-3.

Table 6.2.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.2.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TscAppSessionContextData	M	1	200 OK	An Individual TSC Application Session Context resource is returned successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during an Individual TSC Application Session Context resource retrieval. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during an Individual TSC Application Session Context resource retrieval. (NOTE 2)
NOTE 1: The manadatory HTTP error status code for the GET method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.2.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.2.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.2.3.3.3.2 PATCH

This method shall support the URI query parameters specified in table 6.2.3.3.3.2-1.

Table 6.2.3.3.3.2-1: URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.3.3.3.2-2 and the response data structures and response codes specified in table 6.2.3.3.3.2-3.

Table 6.2.3.3.3.2-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
TscAppSessionContextUpdateData	M	1	Contains the modification(s) to apply to the Individual TSC Application Session Context resource.

Table 6.2.3.3.3.2-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TscAppSessionContextData	M	1	200 OK	Successful case. The Individual TSC Application Session Context resource was modified and a representation of that resource is returned.
n/a			204 No Content	Successful case. The Individual TSC Application Session Context resource was modified.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during an Individual TSC Application Session Context resource modification. (NOTE 3)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during an Individual TSC Application Session Context resource modification. (NOTE 3)
ProblemDetailsTsctsfQosTscac	O	0..1	403 Forbidden	(NOTE 2)

NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the PATCH method shall also apply.
NOTE 2: Failure cases are described in clause 6.2.7.
NOTE 3: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).

Table 6.2.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.2.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.2.3.3.3.2-6: Headers supported by the 403 Response Code on this resource

Name	Data type	P	Cardinality	Description
Retry-After	string	M	1	Indicates the time the NF service consumer has to wait before making a new request.

6.2.3.3.4 Resource Custom Operations

6.2.3.3.4.1 Overview

Table 6.2.3.3.4.1-1: Custom operations

Operation name	Custom operation URI	Mapped HTTP method	Description
delete	/tsc-app-sessions/{appSessionId}/delete	POST	Ntsctsf_QoSandTSCAssistance_Delete. Deletes an existing Individual TSC Application Session Context resource and the child Events Subscription sub-resource.

6.2.3.3.4.2 Operation: delete

6.2.3.3.4.2.1 Description

6.2.3.3.4.2.2 Operation Definition

This custom operation deletes an existing Individual TSC Application Session Context resource and the child Events Subscription sub-resource in the TSCTSF.

This operation shall support the request data structures specified in table 6.2.3.3.4.2.2-1 and the response data structure and response codes specified in table 6.2.3.3.4.2.2-2.

Table 6.2.3.3.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
EventsSubscReqData	O	0..1	Events subscription information to be sent by the NF service consumer to request event notification when the Individual TSC Application Session Context resource is deleted.

Table 6.2.3.3.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The TSC Application Session Context was successfully deleted.
EventsNotification	M	1	200 OK	Successful case. Describes information related to the notification of events.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during an TSC Application Session Context deletion. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during an TSC Application Session Context deletion. (NOTE 2)
NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the POST method shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.2.3.3.4.2.2-3: Headers supported by the 307 Response Code on this resource custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI of the resource custom operation located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.2.3.3.4.2.2-4: Headers supported by the 308 Response Code on this resource custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI of the resource custom operation located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.2.3.4 Resource: Events Subscription (Document)

6.2.3.4.1 Description

The Events Subscription sub-resource represents a subscription to events for a TSC application session context that exists in the Ntsctsf_QoSandTSCAssistance service.

6.2.3.4.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/events-subscription**

This resource shall support the resource URI variables defined in table 6.2.3.4.2-1.

Table 6.2.3.4.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.2.1
appSessionId	string	Identifier of an Individual TSC Application Session Context resource.

6.2.3.4.3 Resource Standard Methods

6.2.3.4.3.1 PUT

This method shall support the URI query parameters specified in table 6.2.3.4.3.1-1.

Table 6.2.3.4.3.1-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.3.4.3.1-2 and the response data structures and response codes specified in table 6.2.3.4.3.1-3.

Table 6.2.3.4.3.1-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
EventsSubscReqData	M	1	Contains information for the modification of the Events Subscription sub-resource.

Table 6.2.3.4.3.1-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
EventsSubscReqData	M	1	201 Created	Successful case. The Events Subscription sub-resource was created.
EventsSubscReqData	M	1	200 OK	Successful case. The Events Subscription sub-resource was modified.
n/a			204 No Content	Successful case. The Events Subscription sub-resource was modified.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during an Events Subscription sub-resource creation. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during an Events Subscription sub-resource creation. (NOTE 2)
NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the PUT method shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.2.3.4.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/events-subscription

Table 6.2.3.4.3.1-5: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.2.3.4.3.1-6: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.2.3.4.3.2 DELETE

This method shall support the URI query parameters specified in table 6.2.3.4.3.2-1.

Table 6.2.3.4.3.2-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.2.3.4.3.2-2 and the response data structures and response codes specified in table 6.2.3.4.3.2-3.

Table 6.2.3.4.3.2-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.2.3.4.3.2-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The Events Subscription sub-resource was deleted.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during an Events Subscription sub-resource deletion. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during an Events Subscription sub-resource deletion. (NOTE 2)
NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the DELETE method shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.2.3.4.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.2.3.4.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.2.3.4.4 Resource Custom Operations

None.

6.2.4 Custom Operations without associated resources

None.

6.2.5 Notifications

6.2.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 6.2.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
Event Notification	{notifUri}/notify	notify (POST)	TSCTSF event notification.
Termination Request	{notifUri}/terminate	terminate (POST)	Request for termination of an Individual TSC Application Session Context.

6.2.5.2 Event Notification

6.2.5.2.1 Description

The Event Notification is used by the TSCTSF to report one or several observed application session context events to the NF service consumer that has subscribed to such notifications via the Events Subscription sub-resource.

6.2.5.2.2 Target URI

The Callback URI **"{notifUri}/notify "** shall be used with the callback URI variables defined in table 6.2.5.2.2-1.

Table 6.2.5.2.2-1: Callback URI variables

Name	Definition
notifUri	The Notification Uri as assigned within the Events Subscription sub-resource and described within the EventsSubscReqData type (see table 6.2.6.2.3-1) or EventsSubscReqDataRm (see table 6.2.6.2.5-1).

6.2.5.2.3 Standard Methods

6.2.5.2.3.1 POST

This method shall support the request data structures specified in table 6.2.5.2.3.1-1 and the response data structures and response codes specified in table 6.2.5.2.3.1-2.

Table 6.2.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
EventsNotification	M	1	Provides Information about observed events.

Table 6.2.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The event notification is received successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during event notification. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during event notification. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.2.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

Table 6.2.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

6.2.5.3 Termination Request

6.2.5.3.1 Description

The Termination Request is used by the TSCTSF to request the NF service consumer the deletion of the Individual TSC Application Session Context resource.

6.2.5.3.2 Target URI

The Callback URI **"{notifUri}/terminate "** shall be used with the callback URI variables defined in table 6.2.5.3.2-1.

Table 6.2.5.3.2-1: Callback URI variables

Name	Definition
notifUri	The Notification Uri as assigned within the Individual TSC Application Session Context resource and described within the TscAppSessionContextData Data type (see table 6.2.6.2.2-1) or TscAppSessionContextUpdateData (see table 6.2.6.2.4-1).

6.2.5.3.3 Standard Methods

6.2.5.3.3.1 POST

This method shall support the request data structures specified in table 6.2.5.3.3.1-1 and the response data structures and response codes specified in table 6.2.5.3.3.1-2.

Table 6.2.5.3.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
TerminationInfo	M	1	Provides information about the deletion of the resource.

Table 6.2.5.3.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The receipt of the Notification is acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during event notification. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during event notification. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.2.5.3.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

Table 6.2.5.3.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

6.2.6 Data Model

6.2.6.1 General

This clause specifies the application data model supported by the API.

Table 6.2.6.1-1 specifies the data types defined for the Ntsctsf_QoSandTSCAssistance service based interface protocol.

Table 6.2.6.1-1: Ntsctsf_QoSandTSCAssistance specific Data Types

Data type	Clause defined	Description	Applicability
AdditionalInfoTsctsfQosTscac	6.2.6.2.8	Describes additional error information specific for this API.	
EventsNotification	6.2.6.2.6	Describes the notification(s) about the event(s) occurred within an Individual TSC Application Session Context resource.	
EventNotification	6.2.6.2.7	Describes the notification for an Event.	
EventsSubscReqData	6.2.6.2.3	Identifies the events the application subscribes to within an Individual TSC Application Session Context resource	
EventsSubscReqDataRm	6.2.6.2.5	This data type is defined in the same way as the "EventsSubscReqData" data type, but with the OpenAPI "nullable: true" property.	
ProblemDetailsTsctsfQosTscac	6.2.6.4.1	Problem details as defined in 3GPP TS 29.571 [15] extended with specific error information for this API, as described in AdditionalInfoTsctsfQosTscac data type.	
TemporalInValidity	6.2.6.2.9	Represents the temporal invalidity conditions, i.e., the time interval during which the NF service consumer request shall not to be applied.	GMEC
TscAppSessionContextData	6.2.6.2.2	Represents the Individual TSC Application Session Context resource data.	
TscAppSessionContextUpdateData	6.2.6.2.4	Describes the modifications to an Individual TSC Application Session Context resource.	
TscEvent	6.2.6.3.3	Indicates the subscribed event(s).	

Table 6.2.6.1-2 specifies data types re-used by the Ntsctsf_QoSandTSCAssistance service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Ntsctsf_QoSandTSCAssistance service based interface.

Table 6.2.6.1-2: Ntsctsf_QoSandTSCAssistance re-used Data Types

Data type	Reference	Comments	Applicability
AcceptableServiceInfo	3GPP TS 29.514 [20]	Acceptable maximum requested bandwidth.	
AccumulatedUsage	3GPP TS 29.122 [21]	Accumulated Usage.	
AlternativeServiceRequirementsData	3GPP TS 29.514 [20]	Contains alternative QoS related parameter sets.	
AspId	3GPP TS 29.514 [20]	Contains an identity of an application service provider.	
BatOffsetInfo	3GPP TS 29.514 [20]	Contains the offset of the BAT and the optionally adjusted periodicity.	EnTSCAC
DateTime	3GPP TS 29.571 [15]	Represents a date and a time.	GMEC
Dnn	3GPP TS 29.571 [15]	The DNN the user is connected to.	
ExternalGroupId	3GPP TS 29.571 [15]	Represents the identifier of an External Group.	GMEC
EthFlowDescription	3GPP TS 29.514 [20]	Defines a packet filter for an Ethernet flow.	
EthFlowInfo	3GPP TS 29.122 [21]	Contains an UL and/or DL Flow information.	Ethernet_UL/DL_Flows
FlowInfo	3GPP TS 29.122 [21]	Contains the IP data flow information.	
Gpsi	3GPP TS 29.571 [15]	Represents a GPSI.	GMEC
IpAddr	3GPP TS 29.571 [15]	Contains the IP address.	
MacAddr48	3GPP TS 29.571 [15]	MAC Address.	
ProblemDetails	3GPP TS 29.571 [15]	Problem Details when returning an error response.	
QosMonitoringInformation	3GPP TS 29.122 [21]	Contains Qos Monitoring information.	
QosMonitoringInformationRm	3GPP TS 29.122 [21]	This data type is defined in the same way as the "QosMonitoringInformation" data type, but with the OpenAPI "nullable: true" property.	
QosMonitoringReport	3GPP TS 29.122 [21]	Contains Qos Monitoring Report information.	
RedirectResponse	3GPP TS 29.571 [15]	Contains redirection related information.	
Snssai	3GPP TS 29.571 [15]	Identifies the S-NSSAI.	
SponId	3GPP TS 29.514 [20]	Contains an Identity of a sponsor.	
SponsoringStatus	3GPP TS 29.514 [20]	Represents whether sponsored data connectivity is enabled or disabled/not enabled.	
SubscribedEvent	3GPP TS 29.522 [17]	Indicates the subscribed event.	
SupportedFeatures	3GPP TS 29.571 [15]	Used to negotiate the applicability of the optional features defined in table 5.8-1.	
TerminationInfo	3GPP TS 29.514 [20]	Includes information related to the termination of the Individual TSC Application Session Context resource.	
TscQosRequirement	3GPP TS 29.122 [21]	Contains the QoS requirements for time sensitive communication.	
TscQosRequirementRm	3GPP TS 29.122 [21]	This data type is defined in the same way as the "TscQosRequirement" data type, but with removable attributes.	

UsageThreshold	3GPP TS 29.122 [21]	Time period and/or traffic volume in which the QoS is to be applied.	
UsageThresholdRm	3GPP TS 29.122 [21]	This data type is defined in the same way as the "UsageThreshold" data type, but with the OpenAPI "nullable: true" property.	
Uri	3GPP TS 29.571 [15]	Identifies a referenced resource.	

6.2.6.2 Structured data types

6.2.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

6.2.6.2.2 Type TscAppSessionContextData

Table 6.2.6.2.2-1: Definition of type TscAppSessionContextData

Attribute name	Data type	P	Cardinality	Description	Applicability
ueIpAddr	IpAddr	C	0..1	The address of the UE. (NOTE 1) (NOTE 5)	
ipDomain	string	C	0..1	The IPv4 address domain identifier. The attribute may only be provided if the ueIpAddr attribute is present and contains an IPv4 address.	
ueMac	MacAddr48	C	0..1	Identifies the MAC address. (NOTE 1) (NOTE 5)	
ueId	Gpsi	C	0..1	Contains the identifier of the targeted UE. (NOTE 5)	GMEC
externalGroupId	ExternalGroupId	C	0..1	Contains the identifier of the targeted group of UE(s). (NOTE 5)	GMEC
dnn	Dnn	O	0..1	Data Network Name, a full DNN with both the Network Identifier and Operator Identifier, or a DNN with the Network Identifier only.	
snssai	Snssai	O	0..1	Identifies the S-NSSAI.	
notifUri	Uri	M	1	Notification URI for Individual TSC Application Session Context termination requests.	
appId	string	C	0..1	Contains the Application Identifier. (NOTE 1)	
flowInfo	array(FlowInfo)	C	1..N	Describe the IP data flow which requires QoS. (NOTE 1) (NOTE 4)	
enEthFlowInfo	array(EthFlowInfo)	C	1..N	Identifies the Ethernet flows which require QoS. Each Ethernet flow consists of a flow identifier and the corresponding UL and/or DL flows. (NOTE 1) (NOTE 4)	Ethernet_UL/DL_Flows
ethFlowInfo	array(EthFlowDescription)	C	1..N	Identifies Ethernet packet flows. (NOTE 1)	
afId	string	M	1	Identifies the AF identifier.	
tscQosReq	TscQosRequirement	C	0..1	Contains the QoS requirements for time sensitive communication. (NOTE 2)	
qosReference	string	M	0..1	Identifies a pre-defined QoS information. (NOTE 2) (NOTE 3)	
altQosReferences	array(string)	C	1..N	Identifies an ordered list of pre-defined QoS information. The lower the index of the array for a given entry, the higher the priority. (NOTE 3)	
altQosReqs	array(AlternativeServiceRequirementsData)	C	1..N	Identifies an ordered list of alternative service requirements that include individual QoS parameter set(s). The lower the index of the array for a given entry, the higher the priority. (NOTE 3)	
sponId	SponId	O	0..1	Sponsor identity.	
aspId	AspId	O	0..1	Contains the Application service provider identity. It shall be included if sponsored connectivity is applicable.	
sponStatus	SponsoringStatus	O	0..1	Indication of whether sponsored connectivity is enabled or disabled/not enabled. The absence of the attribute indicates that the sponsored connectivity is enabled.	
evSubsc	EventsSubscReqData	O	0..1	Identifies the events the application subscribes to at creation of an Individual TSC Application Session Context resource.	

Attribute name	Data type	P	Cardinality	Description	Applicability
tempInValidity	TemporalInValidity	O	0..1	Contains the temporal invalidity conditions, i.e., the time interval during which the AF request is not to be applied.	GMEC
suppFeat	SupportedFeatures	C	0..1	This IE represents a list of Supported features used as described in clause 6.2.8. It shall be supplied by the NF service consumer in the POST request and response of requests a creation of an Individual TSC Application Session Context resource.	

NOTE 1: When the "GMEC" feature is not supported, eirther the "ueIpAddr" attribute or the "ueMac" attribute shall be included. If IP address is provided, IP flow information shall be provided. If ipv4, the domain identifier may be provided. If mac address is provided, Ethernet flow information shall be provided. One of IP flow information, Ethernet flow information or Application Identifier shall be provided.
NOTE 2: When the attributes "reqGbrDl", "reqGbrUl", "reqMbrDl", "reqMbrUl", "maxTscBurstSize", "req5Gsdelay", "reqPer" (if the ExtQoS feature is supported), and "priority" within the "tscQosReq" attribute are provided then the "qosReference" attribute is ignored.
NOTE 3: The attributes "altQoSReferences" and "altQosReqs" are mutually exclusive. If the attribute "altQosReqs" is provided, then the attribute "qosReference shall be ignored.
NOTE 4: When the Ethernet flow information is provided and the Ethernet_UL/DL_Flows feature is supported, either the "ethFlowInfo" or the "enEthFlowInfo" shall be provided, but not both simultaneously.
NOTE 5: When the "GMEC" feature is supported, the "ueId" attribute and the "externalGroupId" attribute are mutually exclusive and either one of them shall be present. If either the "ueId" attribute or the "externalGroupId" attribute are present, then neither the "ueIpAddr" attribute nor the "ueMac" attribute shall be present.

6.2.6.2.3 Type EventsSubscReqData

Table 6.2.6.2.3-1: Definition of type EventsSubscReqData

Attribute name	Data type	P	Cardinality	Description	Applicability
events	array(TscEvent)	M	1..N	Subscribed Events.	
notifUri	Uri	M	1	Notification URI for event notification.	
qosMon	QosMonitoringInformation	C	0..1	Qos Monitoring information. It can be present when the event "QOS_MONITORING" is subscribed.	
usgThres	UsageThreshold	C	0..1	Includes the volume and/or time thresholds for sponsored data connectivity. It can be present when the event "USAGE_REPORT" is subscribed.	
notifCorreId	string	M	1	It is used to set the value of Notification Correlation ID in the corresponding notification.	

6.2.6.2.4 Type TscAppSessionContextUpdateData

Table 6.2.6.2.4-1: Definition of type TscAppSessionContextUpdateData

Attribute name	Data type	P	Cardinality	Description	Applicability
notifUri	Uri	O	0..1	Notification URI for Individual TSC Application Session Context termination requests.	
appId	string	O	0..1	Identifies the external Application Identifier. (NOTE 1)	
flowInfo	array(FlowInfo)	O	1..N	Describe the IP data flow which requires QoS. (NOTE 1)	
ethFlowInfo	array(EthFlowDescription)	O	1..N	Identifies Ethernet packet flows. (NOTE 1) (NOTE 4)	
enEthFlowInfo	array(EthFlowInfo)	O	1..N	Identifies the Ethernet flows which require QoS. Each Ethernet flow consists of a flow identifier and the corresponding UL and/or DL flows. (NOTE 1) (NOTE 4)	Ethernet_UL/DL_Flows
tscQosReq	TscQosRequirementRm	O	0..1	Contains the QoS requirements for time sensitive communication. (NOTE 2)	
qosReference	string	O	0..1	Identifies a pre-defined QoS information. (NOTE 2) (NOTE 3)	
altQosReferences	array(string)	O	1..N	Identifies an ordered list of pre-defined QoS information. The lower the index of the array for a given entry, the higher the priority. (NOTE 3)	
altQosReqs	array(AlternativeServiceRequirementsData)	O	1..N	Identifies an ordered list of alternative service requirements that include individual QoS parameter set(s). The lower the index of the array for a given entry, the higher the priority. (NOTE 3)	
evSubsc	EventsSubscReqDataRm	O	0..1	Identifies the events the application subscribes to at modification of an Individual TSC Application Session Context resource.	
sponId	SponId	O	0..1	Sponsor identity.	
aspId	AspId	O	0..1	Application service provider identity. It may be included if sponsored connectivity is applicable.	
sponStatus	SponsoringStatus	O	0..1	Indication of whether sponsored connectivity is enabled or disabled/not enabled. The absence of the attribute indicates that the sponsored connectivity is enabled.	
tempInValidity	TemporalInValidity	O	0..1	Contains the updated temporal invalidity conditions, i.e., the time interval during which the AF request is not to be applied.	GMEC

NOTE 1: One of IP flow information, Ethernet flow information or Application Identifier may be provided.
NOTE 2: If the "tscQosReq" attribute and "qosReference" attributes are provided, the "qosReference" attribute is ignored.
NOTE 3: The attributes "altQoSReferences" and "altQosReqs" are mutually exclusive.
NOTE 4: When the Ethernet flow information is provided and the Ethernet_UL/DL_Flows feature is supported, either the "ethFlowInfo" or the "enEthFlowInfo" may be provided, but not both simultaneously.

6.2.6.2.5 Type EventsSubscReqDataRm

This data type is defined in the same way as the "EventsSubscReqData" data type, but:

- with the OpenAPI "nullable: true" property; and

- the removable attribute "usgThres" is defined with the removable data type "UsageThresholdRm"; and removable attribute "qosMon" is defined with the removable data type "QosMonitoringInformationRm".

Table 6.2.6.2.5-1: Definition of type EventsSubscReqDataRm

Attribute name	Data type	P	Cardinality	Description	Applicability
events	array(TscEvent)	M	1..N	Subscribed Events.	
notifUri	Uri	O	0..1	Notification URI for event notification.	
qosMon	QosMonitoringInformationRm	O	0..1	Qos Monitoring information. It can be present when the event "QOS_MONITORING" is subscribed.	
usgThres	UsageThresholdRm	C	0..1	Includes the volume and/or time thresholds for sponsored data connectivity. It can be present when the notified event is "USAGE_REPORT".	
notifCorreId	string	O	0..1	It is used to set the value of Notification Correlation ID in the corresponding notification.	

6.2.6.2.6 Type EventsNotification

Table 6.2.6.2.6-1: Definition of type EventsNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
notifCorreId	string	M	1	It is used to set the value of Notification Correlation ID in the corresponding notification.	
events	array(EventNotification)	M	1..N	Contains the reported event(s).	

6.2.6.2.7 Type EventNotification

Table 6.2.6.2.7-1: Definition of type EventNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
event	TscEvent	M	1	Indicates the event reported by the TSCTSF.	
flowIds	array(integer)	O	1..N	Identifies the flows that were sent during event subscription	
qosMonReports	array(QosMonitoringReport)	C	1..N	QoS Monitoring reporting information. It shall be present when the notified event is "QOS_MONITORING".	
appliedQosRef	string	C	0..1	The currently applied alternative QoS requirement referring to an alternative QoS reference or a requested alternative QoS parameter set. Applicable for event QOS_NOT_GUARANTEED or SUCCESSFUL_RESOURCES_ALLOCATION. When it is omitted and the "event" attribute is QOS_NOT_GUARANTEED, the event report indicates that the lowest priority alternative QoS profile could not be fulfilled either.	
usgRep	AccumulatedUsage	C	0..1	Indicates the measured volume and/or time for sponsored data connectivity. Applicable for event USAGE_REPORT.	
altQosNotSuppInd	boolean	O	0..1	It may be set to true when the "event" attribute is QOS_NOT_GUARANTEED to indicate that alternative service requirements are not supported by NG-RAN. The default value false shall apply if the attribute is not present.	AltQoSProfilesSupportReport
batOffsetInfo	BatOffsetInfo	C	0..1	The offset of the BAT and the optionally adjusted periodicity. It shall be present if available when the notified event is "BAT_OFFSET_INFO".	EnTSCAC

6.2.6.2.8 Type AdditionalInfoTsctsfQosTscac

Table 6.2.6.2.8-1: Definition of type AdditionalInfoTsctsfQosTscac

Attribute name	Data type	P	Cardinality	Description	Applicability
acceptableServInfo	AcceptableServiceInfo	O	0..1	Describes information related to the acceptable service information, i.e., the maximum acceptable bandwidth for an AF session and/or for specific media components.	

6.2.6.2.9 Type TemporalInValidity

Table 6.2.6.2.9-1: Definition of type TemporalnValidity

Attribute name	Data type	P	Cardinality	Description	Applicability
startTime	DateTime	M	1	Indicates the time at which the AF request ceases to apply. The absence of this attribute indicates that the AF request does not end at any time.	
stopTime	DateTime	M	1	Indicates the time at which the AF request starts to apply. The absence of this attribute indicates the AF request applies immediately.	

6.2.6.3 Simple data types and enumerations

6.2.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.2.6.3.2 Simple data types

The simple data types defined in table 6.2.6.3.2-1 shall be supported.

Table 6.2.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability
	<one simple data type, i.e. boolean, integer, number, or string>		

6.2.6.3.3 Enumeration: TscEvent

The enumeration TscEvent represents event for TSC. It shall comply with the provisions defined in table 6.2.6.3.3-1.

Table 6.2.6.3.3-1: Enumeration TscEvent

Enumeration value	Description	Applicability
FAILED_RESOURCES_ALLOCATION	Indicates that one or more of the SDFs of an Individual TSC Application Session Context are deactivated. It also indicates that the resources requested for a particular service information cannot be successfully allocated.	
SUCCESSFUL_RESOURCES_ALLOCATION	Indicates that the resources requested for particular service information have been successfully allocated.	
QOS_GUARANTEED	The QoS targets of one or more SDFs are guaranteed again.	
QOS_NOT_GUARANTEED	The QoS targets of one or more SDFs are not being guaranteed.	
QOS_MONITORING	Indicates a QoS monitoring event.	
USAGE_REPORT	Volume and/or time usage for sponsored data connectivity.	
BAT_OFFSET_INFO	Indicates the BAT offset and the optionally adjusted periodicity.	EnTSCAC

6.2.6.4 Data types describing alternative data types or combinations of data types

6.2.6.4.1 Type: ProblemDetailsTsctsfQosTscac

Table 6.2.6.4.1-1: Definition of type ProblemDetailsTsctsfQosTscac as a list of to be combined data types

Data type	Cardinality	Description	Applicability
ProblemDetails	1	Problem details when returning an error response as specified in 3GPP TS 29.571 [15].	
AdditionalInfoTsctsfQosTscac	1	Describes additional error information specific for this API.	

6.2.7 Error Handling

6.2.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

For the Ntsctsf_QoSandTSCAssistance API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Ntsctsf_QoSandTSCAssistance API.

6.2.7.2 Protocol Errors

No specific procedures for the Ntsctsf_QoSandTSCAssistance service are specified.

6.2.7.3 Application Errors

The application errors defined for the Ntsctsf_QoSandTSCAssistance service are listed in Table 6.2.7.3-1.

Table 6.2.7.3-1: Application errors

Application Error	HTTP status code	Description
REQUESTED_SERVICE_NOT_AUTHORIZED	403 Forbidden	The service information provided in the request is rejected.
REQUESTED_SERVICE_TEMPORARILY_NOT_AUTHORIZED	403 Forbidden	The service information provided in the request is temporarily rejected.
UNAUTHORIZED_SPONSORED_DATA_CONNECTIVITY	403 Forbidden	The request for sponsored data connectivity is not authorized.
PDU_SESSION_NOT_AVAILABLE	500 Internal Server Error	The PDU session is not found for the provided UE address.

6.2.8 Feature negotiation

The optional features in table 6.2.8-1 are defined for the Ntsctsf_QoSandTSCAssistance API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.2.8-1: Supported Features

Feature number	Feature Name	Description
1	Ethernet_UL/DL_Flows	Indicates the support of the description of the Ethernet flows as the combination of Flow Identifier, and UL and/or DL Ethernet flows.
2	PacketDelayFailureReport	Indicates the support of packet delay failure report as part of QoS Monitoring procedures.
3	ExtQoS	Indicates the support of extended QoS parameters.
4	EnTSCAC	Indicates the support of extensions to TSCAC, e.g. burst arrival time window adaptation, periodicity adjustment, and subsequent BAT offset report.
5	AltQoSProfilesSupportReport	This feature indicates the support of the report of whether Alternative QoS parameters are supported by NG-RAN.
6	GMEC	This feature indicates the support of Generic Group Management, Exposure and Communication Enhancements. The following functionalities are supported: - AF requested QoS for a UE or a group of UE(s) not identified by UE address(es).

6.2.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Ntsctsf_QoSandTSCAssistance API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Ntsctsf_QoSandTSCAssistance API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Ntsctsf_QoSandTSCAssistance service.

The Ntsctsf_QoSandTSCAssistance API defines a single scope "ntsctsf-qos-tscai" for the entire service, and it does not define any additional scopes at resource or operation level.

6.3 Ntsctsf_ASTI Service API

6.3.1 Introduction

The Ntsctsf_ASTI service shall use the Ntsctsf_ASTI API.

The API URI of the Ntsctsf_ASTI API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "ntsctsf-asti".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.3.3.

6.3.2 Usage of HTTP

6.3.2.1 General

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Ntsctsf_ASTI API is contained in Annex A.4.

6.3.2.2 HTTP standard headers

6.3.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

6.3.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 9457 [13].

6.3.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

In this Release of the specification, no specific custom headers are defined for the Ntsctsf_ASTI API.

6.3.3 Resources

6.3.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.2.3.1-1 depicts the resource URIs structure for the Ntsctsf_ASTI API.

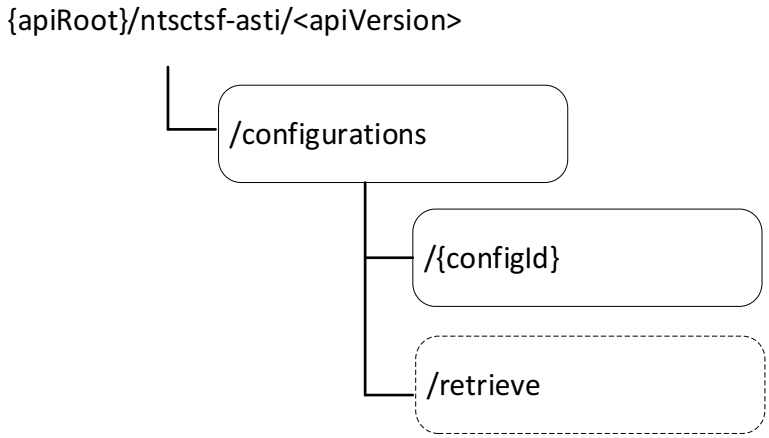

Figure 6.3.3.1-1: Resource URI structure of the Ntsctsf_ASTI API

Table 6.3.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.3.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
ASTI Configurations	/configurations	POST	Create a new configuration of the 5G access stratum time distribution and optionally subscribe for 5G access stratum time distribution status.
		retrieve (POST)	Request the status of the access stratum time distribution for a list of UEs.
Individual ASTI Configuration	/configurations/{configId}	PUT	Request to update the 5G access stratum time distribution configuration and optionally subscribe for 5G access stratum time distribution status.
		DELETE	Request to delete the 5G access stratum time distribution configuration and related subscription for 5G access stratum time distribution status.

6.3.3.2 Resource: ASTI Configurations

6.3.3.2.1 Description

This resource allows a NF service consumer to create a new Individual ASTI Configuration resource.

6.3.3.2.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-asti/<apiVersion>/configurations**

This resource shall support the resource URI variables defined in table 6.3.3.2.2-1.

Table 6.3.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.3.1

6.3.3.2.3 Resource Standard Methods

6.3.3.2.3.1 POST

This method shall support the URI query parameters specified in table 6.3.3.2.3.1-1.

Table 6.3.3.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures specified in table 6.3.3.2.3.1-2 and the response data structures and response codes specified in table 6.3.3.2.3.1-3.

Table 6.3.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AccessTimeDistributionData	M	1	Contains the information for the creation of a new Individual ASTI Configuration resource.

Table 6.3.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AccessTimeDistributionData	M	1	201 Created	The resource was created successfully and a representation of the created resource is returned. The URI of the created resource shall be returned in the "Location" HTTP header.
ProblemDetails	O	0..1	403 Forbidden	(NOTE 2)
NOTE 1: The manadtory HTTP error status code for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: Failure cases are described in clause 6.3.7.				

Table 6.3.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}

6.3.3.2.4 Resource Custom Operations

6.3.3.2.4.1 Overview

Table 6.3.3.2.4.1-1: Custom operations

Operation Name	Custom operation URI	Mapped HTTP method	Description
Retrieve	/configurations/retrieve	POST	Request the status of the 5G access stratum time distribution for a list of UEs.

6.3.3.2.4.2 Operation: Retrieve

6.3.3.2.4.2.1 Description

6.3.3.2.4.2.2 Operation Definition

This custom operation retrieves the status of the access stratum time distribution for a list of UEs.

This operation shall support the request data structures specified in table 6.3.3.2.4.2.2-1 and the response data structure and response codes specified in table 6.3.3.2.4.2.2-2.

Table 6.3.3.2.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
StatusRequestData	M	1	Parameters to be sent by the NF service consumer when the status of the 5G access stratum time distribution for a list of UEs is requested.

Table 6.3.3.2.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
StatusResponseData	M	1	200 OK	Status of the 5G access stratum time distribution for a list of UEs is returned.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.3.3.2.4.2.2-3: Headers supported by the 307 Response Code on this resource custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI of the resource custom operation located in an alternative TSCTSF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request should be redirected.

Table 6.3.3.2.4.2.2-4: Headers supported by the 308 Response Code on this resource custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI of the resource custom operation located in an alternative TSCTSF (service) instance towards which the request should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request should be redirected.

6.3.3.3 Resource: Individual ASTI Configuration

6.3.3.3.1 Description

This resource allows a NF service consumer to read, modify or delete an existing Individual ASTI Configuration resource.

6.3.3.3.2 Resource Definition

Resource URI: **{apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}**

This resource shall support the resource URI variables defined in table 6.3.3.3.2-1.

Table 6.3.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.3.1
configId	string	Identifier of an Individual ASTI Configuration resource.

6.3.3.3.3 Resource Standard Methods

6.3.3.3.3.1 Void.

6.3.3.3.3.2 PUT

This method shall support the URI query parameters specified in table 6.3.3.3.3.2-1.

Table 6.3.3.3.3.2-1: URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.3.3.3.3.2-2 and the response data structures and response codes specified in table 6.3.3.3.3.2-3.

Table 6.3.3.3.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
AccessTimeDistributionData	M	1	Contains the modification(s) to apply to the Individual ASTI Configuration resource.

Table 6.3.3.3.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AccessTimeDistributionData	M	1	200 OK	Successful case. The Individual ASTI Configuration resource was modified and a representation of that resource is returned.
n/a			204 No Content	Successful case. The Individual ASTI Configuration resource was modified.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during an Individual ASTI Configuration resource modification. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during an Individual ASTI Configuration resource modification. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the PUT method shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.3.7.				

Table 6.3.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.3.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.3.3.3.3 DELETE

This method shall support the URI query parameters specified in table 6.3.3.3.3-1.

Table 6.3.3.3.3-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.3.3.3.3-2 and the response data structures and response codes specified in table 6.3.3.3.3-3.

Table 6.3.3.3.3.3-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.3.3.3.3.3-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The configuration was terminated successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during an Individual ASTI Configuration resource modification deletion. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during an Individual ASTI Configuration resource modification deletion. (NOTE 2)
NOTE 1: In addition, the HTTP status codes which are specified as mandatory in table 5.2.7.1-1 of 3GPP TS 29.500 [4] for the DELETE method shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.3.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

Table 6.3.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI of the resource located in an alternative TSCTSF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target TSCTSF (service) instance towards which the request is redirected.

6.3.3.3.4 Resource Custom Operations

None.

6.3.4 Custom Operations without associated resources

None.

6.3.5 Notifications

6.3.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 6.3.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
ASTI Notification	{astiNotifUri}	POST	ASTI notification.

6.3.5.2 ASTI Notification

6.3.5.2.1 Description

The ASTI Notification is used by the NF service producer to report the changes on the ASTI service.

6.3.5.2.2 Target URI

The Callback URI **"{astiNotifUri}"** shall be used with the callback URI variables defined in table 6.3.5.2.2-1.

Table 6.3.5.2.2-1: Callback URI variables

Name	Definition
astiNotifUri	String formatted as URI with the Callback Uri. The Callback Uri is assigned within the Individual ASTI Configuration resource and described within the AccessTimeDistributionData data type (see table 6.3.6.2.2-1).

6.3.5.2.3 Standard Methods

6.3.5.2.3.1 POST

This method shall support the request data structures specified in table 6.3.5.2.3.1-1 and the response data structures and response codes specified in table 6.3.5.2.3.1-1.

Table 6.3.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
AstiConfigNotification	M	1	Provides the change in the 5G Access Stratum Time Distribution configuration.

Table 6.3.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	The event notification is received successfully.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection, during event notification. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection, during event notification. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.3.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

Table 6.3.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance towards which the notification request is redirected

6.3.6 Data Model

6.3.6.1 General

This clause specifies the application data model supported by the API.

Table 6.3.6.1-1 specifies the data types defined for the Ntsctsf_ASTI service based interface protocol.

Table 6.3.6.1-1: Ntsctsf_ASTI specific Data Types

Data type	Clause defined	Description	Applicability
AccessTimeDistributionData	6.3.6.2.2	Contains the parameters for the creation of 5G access stratum time distribution configuration.	
ActiveUe	6.3.6.2.6	Contains the UE identifier whose status of the 5G access stratum time distribution is active and the optional requested time synchronization error budget.	
AstiConfigNotification	6.3.6.2.7	Contains the report of a change in the 5G Access Stratum Time Distribution parameters applied to the UE(s).	ASTIConfigReport
AstiConfigStateNotification	6.3.6.2.8	Contains the report about a change in the 5G Access Stratum Time Distribution parameters for a UE.	ASTIConfigReport
AstiEvent	6.3.6.3.3	ASTI Event.	ASTIConfigReport
AfAsTimeDistributionParam	6.3.6.2.3	Contains the 5G access stratum time distribution parameters requested by the AF.	
StatusRequestData	6.3.6.2.4	Contains the parameters for retrieval of the status of the 5G access stratum time distribution for a list of UEs.	
StatusResponseData	6.3.6.2.5	Contains the parameters for the status of the 5G access stratum time distribution for a list of UEs.	

Table 6.3.6.1-2 specifies data types re-used by the Ntsctsf_ASTI service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Ntsctsf_ASTI service based interface.

Table 6.3.6.1-2: Ntsctsf_ASTI re-used Data Types

Data type	Reference	Comments	Applicability
ClockQualityAcceptanceCriterion	3GPP TS 29.571 [15]	Identifies clock quality acceptance criteria information.	NetTimeSyncStatus
ClockQualityDetailLevel	3GPP TS 29.571 [15]	Indicates the clock quality detail level information.	NetTimeSyncStatus
ExternalGroupId	3GPP TS 29.571 [15]	Identifies an External Group.	
Gpsi	3GPP TS 29.571 [15]	The external identification of the user (i.e., an External Id or an MSISDN).	
GroupId	3GPP TS 29.571 [15]	Identifies a group of internal globally unique ID.	
ProblemDetails	3GPP TS 29.571 [15]	Problem Details when returning an error response.	
RedirectResponse	3GPP TS 29.571 [15]	Contains redirection related information.	
ServiceAreaCoverageInfo	3GPP TS 29.534 [14]	It represents a list of Tracking Areas within a serving network.	CoverageAreaSupport
Supi	3GPP TS 29.571 [15]	The identification of the user (i.e. IMSI, NAI).	
SupportedFeatures	3GPP TS 29.571 [15]	Used to negotiate the applicability of the optional features defined in table 6.3.8-1.	
TemporalValidity	3GPP TS 29.514 [20]	TemporalValidity	
Uinteger	3GPP TS 29.571 [15]	Unsigned integer.	
Uri	3GPP TS 29.571 [15]	Identifies a referenced resource.	ASTIConfigReport

6.3.6.2 Structured data types

6.3.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

6.3.6.2.2 Type: AccessTimeDistributionData

Table 6.3.6.2.2-1: Definition of type AccessTimeDistributionData

Attribute name	Data type	P	Cardinality	Description	Applicability
supis	array(Supi)	C	1..N	Subscription Permanent Identifier(s). (NOTE 1)	
gpsis	array(Gpsi)	C	1..N	Public user Identifier(s). (NOTE 1)	
interGrpId	GroupId	C	0..1	The internal Group Id(s). (NOTE 1)	
exterGrpId	ExternalGroupId	C	0..1	The external Group Id(s). (NOTE 1)	
asTimeDisParam	AfAsTimeDistributionParam	M	1	AF requested 5G access stratum time distribution parameters. (NOTE 2)	
covReq	array(ServiceAreaCoverageInfo)	O	1..N	Identifies a list of AF provided Tracking Areas per serving network where the 5GS access stratum time distribution service is allowed.	CoverageAreaSupport
astiNotifUri	Uri	C	0..1	Notification URI for reporting changes in 5G access stratum time distribution status, and/or reporting the 5G access stratum time distribution information. It shall be provided if the ASTIConfigReport feature is supported and/or the NetTimeSyncStatus feature is supported.	ASTIConfigReport
astiNotifId	string	C	0..1	Notification Correlation ID assigned by the NF service consumer. It shall be provided if the ASTIConfigReport feature is supported.	ASTIConfigReport
suppFeat	SupportedFeatures	C	0..1	Represents the features supported by the NF service consumer. This parameter shall be supplied by the NF service consumer in the POST request and the response that requested the creation of an Individual ASTI Configuration resource.	
NOTE 1: One of "supis", "gpsis", "exterGroupId" or "interGrpId" attributes shall be provided. NOTE 2: The "clkQltDetLvl" attribute and the "clkQltAcptCri" attribute (if applicable) within "asTimeDisParam" attribute may be provided only if the "NetTimeSyncStatus" feature is supported.					

6.3.6.2.3 Type: AfAsTimeDistributionParam

Table 6.3.6.2.3-1: Definition of type AfAsTimeDistributionParam

Attribute name	Data type	P	Cardinality	Description	Applicability
asTimeDisEnabled	boolean	O	0..1	When this attribute is included and set to true, it indicates that the access stratum time distribution via Uu reference point is activated. When present it shall be set as follows: - true: activated. - false (default): deactivated.	
timeSyncErrBdgt	Uinteger	O	0..1	Indicates the time synchronization error budget in terms of time units of nanoseconds.	
tempValidity	TemporalValidity	O	0..1	Indicates the time interval during which the AF request is to be applied.	
clkQltDetLvl	ClockQualityDetailLevel	O	0..1	For ASTI services, its value, if provided, shall be set to "ACCEPT_INDICATION"	NetTimeSyncStatus
clkQltAcptCri	ClockQualityAcceptanceCriterion	C	0..1	It indicates the acceptable clock quality acceptance criteria for the UE, and it is used to determine whether the time synchronization status for the ASTI service is acceptable/not acceptable. It shall be present when the "clkQltDetLvl" attribute is present.	NetTimeSyncStatus

6.3.6.2.4 Type: StatusRequestData

Table 6.3.6.2.4-1: Definition of type StatusRequestData

Attribute name	Data type	P	Cardinality	Description	Applicability
supis	array(Supi)	C	1..N	Subscription Permanent Identifier(s).	
gpsis	array(Gpsi)	C	1..N	Public User Identifier(s).	
NOTE: Either the "supis" or the "gpsis" attribute is included.					

6.3.6.2.5 Type: StatusResponseData

Table 6.3.6.2.5-1: Definition of type StatusResponseData

Attribute name	Data type	P	Cardinality	Description	Applicability
inactiveUes	array(Supi)	O	1..N	Indicate the SUPI(s) whose status of the access stratum time distribution is inactive. (NOTE)	
inactiveGpsis	array(Gpsi)	O	1..N	Indicate the GPSI(s) whose status of the access stratum time distribution is inactive. (NOTE)	
activeUes	array(ActiveUe)	O	1..N	Contains the UE identifier(s) whose status of the access stratum time distribution is active and the optional requested time synchronization error budget.	
NOTE: Either the "inactiveUes" or the "inactiveGpsis" attribute is included, based on whether the request contained an internal or an external identifier.					

6.3.6.2.6 Type: ActiveUe

Table 6.3.6.2.6-1: Definition of type ActiveUe

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	C	0..1	Indicate the SUPI whose status of the access stratum time distribution is active. (NOTE)	
gpsi	Gpsi	C	0..1	Indicate the GPSI whose status of the access stratum time distribution is active. (NOTE)	
timeSyncErrBdgt	Uinteger	O	0..1	Indicates the time synchronization error budget in terms of time units of nanoseconds.	
NOTE: Either the "supi" or the "gpsi" attribute is included, based on whether the request contained an internal or an external identifier.					

6.3.6.2.7 Type AstiConfigNotification

Table 6.3.6.2.7-1: Definition of type AstiConfigNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
astiNotifId	string	M	1	It is used to set the value of Notification Correlation ID in the corresponding notification.	
stateConfigs	array(AstiConfigStateNotification)	M	1..N	Contains change of state of 5G access stratum time distribution configuration.	

6.3.6.2.8 Type AstiConfigStateNotification

Table 6.3.6.2.8-1: Definition of type AstiConfigStateNotification

Attribute name	Data type	P	Cardinality	Description	Applicability
supi	Supi	C	0..1	Identifies the UE to which the status below apply. (NOTE)	
gpsi	Gpsi	C	0..1	Identifies the UE to which the status below apply. (NOTE)	
event	AstiEvent	M	1	Indicates the reported event.	
NOTE: Only one of the properties "supi" or "gpsi" shall be included.					

6.3.6.3 Simple data types and enumerations

6.3.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.3.6.3.2 Simple data types

The simple data types defined in table 6.3.6.3.2-1 shall be supported.

Table 6.3.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.3.6.3.3 Enumeration: AstiEvent

The enumeration AstiEvent represents event for ASTI service. It shall comply with the provisions defined in table 6.3.6.3.3-1.

Table 6.3.6.3.3-1: Enumeration AstiEvent

Enumeration value	Description	Applicability
ASTI_ENABLED	Indicates that the access stratum time distribution via Uu reference point is activated.	
ASTI_DISABLED	Indicates that the access stratum time distribution via Uu reference point is deactivated.	
CLOCK_QUAL_ACCEPTABLE	Indicates the UE meets the clock quality acceptance criteria.	NetTimeSyncStatus
CLOCK_QUAL_NON_ACCEPTABLE	Indicates the UE does not meet the clock quality acceptance criteria	NetTimeSyncStatus

6.3.7 Error Handling

6.3.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [5].

For the Ntsctsf_ASTI API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Ntsctsf_ASTI API.

6.3.7.2 Protocol Errors

No specific procedures for the Ntsctsf_ASTI service are specified.

6.3.7.3 Application Errors

The application errors defined for the Ntsctsf_ASTI service are listed in Table 6.3.7.3-1.

Table 6.3.7.3-1: Application errors

Application Error	HTTP status code	Description	Applicability
UE_SERVICE_NOT_AUTHORIZED	403 Forbidden	The AF request is not authorized, or the AF requested parameter(s) are not authorized by UE's Time Synchronization Data in UDM	SupportReport

6.3.8 Feature negotiation

The optional features in table 6.3.8-1 are defined for the Ntsctsf_ASTI API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.3.8-1: Supported Features

Feature number	Feature Name	Description
1	CoverageAreaSupport	Indicates the support of time synchronization coverage area conditions for the activation/deactivation of the time synchronization service. It requires the support of ASTIConfigReport feature.
2	ASTIConfigReport	Indicates the support of the report of ASTI service status information and/or ASTI configuration changes.
3	NetTimeSyncStatus	Indicates the support of the provisioning of clock quality reporting control information and the subscription to ASTI time synchronization service status. It requires the support of ASTIConfigReport feature.
4	SupportReport	This feature indicates the support of the report of whether the requested Time Synchronization is authorized for the requested UE's based on the UE's Time Synchronization Subscription Data in UDM.

6.3.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Ntsctsf_ASTI API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Ntsctsf_ASTI API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [10], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Ntsctsf_ASTI service.

The Ntsctsf_ASTI API defines a single scope "ntsctsf-asti" for the entire service, and it does not define any additional scopes at resource or operation level.

Annex A (normative): OpenAPI specification

A.1 General

This Annex specifies the formal definition of the API(s) defined in the present specification. It consists of OpenAPI specifications in YAML format.

This Annex takes precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API(s).

NOTE 1: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository that uses the GitLab software version control system (see 3GPP TS 29.501 [5] clause 5.3.1 and 3GPP TR 21.900 [7] clause 5B).

A.2 Ntsctsf_TimeSynchronization API

```
openapi: 3.0.0

info:
  title: Ntsctsf_TimeSynchronization Service API
  version: 1.1.2
  description: |
    TSCTSF Time Synchronization Service.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 29.565 V18.8.0; 5G System; Time Sensitive Communication and Time Synchronization
Function
    Services; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.565/'
servers:
  - url: '{apiRoot}/ntsctsf-time-sync/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:
  - {}
  - oAuth2ClientCredentials:
    - ntsctsf-time-sync

paths:
  /subscriptions:
    post:
      summary: Creates a new subscription to notification of capability of time synchronization
service resource
      operationId: TimeSynchronizationExposureSubscriptions
      tags:
        - Time Synchronization Exposure Subscriptions (Collection)
      requestBody:
        description: Contains the information for the creation the resource.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TimeSyncExposureSubsc'
      responses:
        '201':
          description: Successful creation of the resource.
```

```
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/TimeSyncExposureSubsc'
      headers:
        Location:
          description: >
            Contains the URI of the created individual time synchronization exposure
            subscription resource, according to the structure
            {apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}
          required: true
          schema:
            type: string
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '502':
      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    subsEventNotification:
      '{$request.body#/subsNotifUri}':
        post:
          requestBody:
            description: Notification of an event occurrence in the TSCTSF.
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/TimeSyncExposureSubsNotif'
          responses:
            '204':
              description: The receipt of the notification is acknowledged.
            '307':
              $ref: 'TS29571_CommonData.yaml#/components/responses/307'
            '308':
              $ref: 'TS29571_CommonData.yaml#/components/responses/308'
            '400':
              $ref: 'TS29571_CommonData.yaml#/components/responses/400'
            '401':
              $ref: 'TS29571_CommonData.yaml#/components/responses/401'
            '403':
              $ref: 'TS29571_CommonData.yaml#/components/responses/403'
            '404':
              $ref: 'TS29571_CommonData.yaml#/components/responses/404'
            '411':
              $ref: 'TS29571_CommonData.yaml#/components/responses/411'
            '413':
              $ref: 'TS29571_CommonData.yaml#/components/responses/413'
            '415':
              $ref: 'TS29571_CommonData.yaml#/components/responses/415'
            '429':
              $ref: 'TS29571_CommonData.yaml#/components/responses/429'
            '500':
              $ref: 'TS29571_CommonData.yaml#/components/responses/500'
            '502':
              $ref: 'TS29571_CommonData.yaml#/components/responses/502'
            '503':
              $ref: 'TS29571_CommonData.yaml#/components/responses/503'
            default:
```

```
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /subscriptions/{subscriptionId}:
    get:
      summary: "Reads an existing Individual Time Synchronization Exposure Subscription"
      operationId: GetIndividualTimeSynchronizationExposureSubscription
      tags:
        - Individual Time Synchronization Exposure Subscription (Document)
      parameters:
        - name: subscriptionId
          description: String identifying an Individual Time Synchronization Exposure Subscription
          in: path
          required: true
          schema:
            type: string
      responses:
        '200':
          description: A representation of the resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TimeSyncExposureSubsc'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    put:
      operationId: ReplaceIndividualTimeSynchronizationExposureSubscription
      summary: Replace an individual Time Synchronization Exposure Subscription
      tags:
        - IndividualTimeSynchronizationExposureSubscription (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TimeSyncExposureSubsc'
      parameters:
        - name: subscriptionId
          description: String identifying an Individual Time Synchronization Exposure Subscription.
          in: path
          required: true
          schema:
            type: string
      responses:
        '200':
          description: OK. Resource was successfully modified and representation is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TimeSyncExposureSubsc'
        '204':
          description: No Content. Resource was successfully modified.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
```

```
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  delete:
    operationId: DeleteIndividualTimeSynchronizationExposureSubscription
    summary: Delete an Individual TimeSynchronization Exposure Subscription
    tags:
      - Individual Time Synchronization Exposure Subscription (Document)
    parameters:
      - name: subscriptionId
        in: path
        description: String identifying an Individual Time Synchronization Exposure Subscription.
        required: true
        schema:
          type: string
    responses:
      '204':
        description: No Content. Resource was successfully deleted.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

/subscriptions/{subscriptionId}/configurations:
  post:
    summary: "Create a new Individual Time Synchronization Exposure Configuration"
    operationId: CreateIndividualTimeSynchronizationExposureConfiguration
    tags:
      - Individual Time Synchronization Exposure Configuration (Document)
    parameters:
      - name: subscriptionId
        description: String identifying an Individual Time Synchronization Exposure Subscription.
        in: path
        required: true
        schema:
          type: string
    requestBody:
      description: Contains the information for the creation the resource.
      required: true
      content:
```

```
      application/json:
        schema:
          $ref: '#/components/schemas/TimeSyncExposureConfig'
  responses:
    '201':
      description: Successful creation of the resource.
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/TimeSyncExposureConfig'
      headers:
        Location:
          description: >
            Contains the URI of the created individual time synchronization exposure
            configuration resource, according to the structure
            {apiRoot}/ntsctsf-time-sync/<apiVersion>/subscriptions/{subscriptionId}
            /configurations/{configurationId}
          required: true
          schema:
            type: string
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '502':
      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    configEventNotification:
      '{$request.body#/configNotifUri}':
        post:
          requestBody:
            description: Notification of an event occurrence in the TSCTSF.
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/TimeSyncExposureConfigNotif'
          responses:
            '204':
              description: The receipt of the notification is acknowledged.
            '307':
              $ref: 'TS29571_CommonData.yaml#/components/responses/307'
            '308':
              $ref: 'TS29571_CommonData.yaml#/components/responses/308'
            '400':
              $ref: 'TS29571_CommonData.yaml#/components/responses/400'
            '401':
              $ref: 'TS29571_CommonData.yaml#/components/responses/401'
            '403':
              $ref: 'TS29571_CommonData.yaml#/components/responses/403'
            '404':
              $ref: 'TS29571_CommonData.yaml#/components/responses/404'
            '411':
              $ref: 'TS29571_CommonData.yaml#/components/responses/411'
            '413':
              $ref: 'TS29571_CommonData.yaml#/components/responses/413'
```

```
              '415':
                $ref: 'TS29571_CommonData.yaml#/components/responses/415'
              '429':
                $ref: 'TS29571_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29571_CommonData.yaml#/components/responses/500'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /subscriptions/{subscriptionId}/configurations/{configurationId}:
    get:
      summary: "Reads an existing Individual Time Synchronization Exposure Configuration"
      operationId: GetIndividualTimeSynchronizationExposureConfiguration
      tags:
        - Individual Time Synchronization Exposure Configuration (Document)
      parameters:
        - name: subscriptionId
          description: String identifying an Individual Time Synchronization Exposure Subscription.
          in: path
          required: true
          schema:
            type: string
        - name: configurationId
          description: String identifying an Individual Time Synchronization Exposure Configuration.
          in: path
          required: true
          schema:
            type: string
      responses:
        '200':
          description: A representation of the resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TimeSyncExposureConfig'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '406':
          $ref: 'TS29571_CommonData.yaml#/components/responses/406'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    put:
      operationId: ReplaceIndividualTimeSynchronizationExposureConfiguration
      summary: Replace an individual Time Synchronization Exposure Configuration
      tags:
        - IndividualTimeSynchronizationExposureConfiguration (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TimeSyncExposureConfig'
      parameters:
        - name: subscriptionId
          description: String identifying an Individual Time Synchronization Exposure Subscription.
          in: path
```

```
        required: true
        schema:
          type: string
      - name: configurationId
        description: String identifying an Individual Time Synchronization Exposure Configuration.
        in: path
        required: true
        schema:
          type: string
    responses:
      '200':
        description: OK. Resource was successfully modified and representation is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TimeSyncExposureConfig'
      '204':
        description: No Content. Resource was successfully modified.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  delete:
    operationId: DeleteIndividualTimeSynchronizationExposureConfiguration
    summary: Delete an Individual TimeSynchronization Exposure Configuration
    tags:
      - Individual Time Synchronization Exposure Configuration (Document)
    parameters:
      - name: subscriptionId
        in: path
        description: String identifying an Individual Time Synchronization Exposure Subscription.
        required: true
        schema:
          type: string
      - name: configurationId
        description: String identifying an Individual Time Synchronization Exposure Configuration.
        in: path
        required: true
        schema:
          type: string
    responses:
      '204':
        description: No Content. Resource was successfully deleted
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
```

```
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            ntsctsf-time-sync: Access to the Ntsctsf_TimeSynchronization API

  schemas:
    TimeSyncExposureSubsc:
      description: >
        Contains the parameters for the subscription to notification of capability of time
        synchronization service.
      type: object
      properties:
        supis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
          minItems: 1
        gpsis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
          minItems: 1
        interGrpId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
        exterGrpId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ExternalGroupId'
        anyUeInd:
          type: boolean
          description: >
            Identifies whether the request applies to any UE. This attribute shall set to true if
            applicable for any UE, otherwise, set to false.
        notifMethod:
          $ref: 'TS29508_Nsmf_EventExposure.yaml#/components/schemas/NotificationMethod'
        dnn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        snssai:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        subscribedEvents:
          type: array
          items:
            $ref: 'TS29522_TimeSyncExposure.yaml#/components/schemas/SubscribedEvent'
          minItems: 1
        eventFilters:
          type: array
          items:
            $ref: 'TS29522_TimeSyncExposure.yaml#/components/schemas/EventFilter'
          minItems: 1
        subsNotifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        subsNotifId:
          type: string
          description: Notification Correlation ID assigned by the NF service consumer.
        maxReportNbr:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        expiry:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        repPeriod:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
```

```
      required:
        - subsNotifUri
        - subsNotifId
        - dnn
        - snssai
        - subscribedEvents
      oneOf:
        - required: [supis]
        - required: [interGrpId]
        - required: [gpsis]
        - required: [exterGrpId]
        - required: [anyUeInd]

    TimeSyncExposureSubsNotif:
      description: Contains the notification of time synchronization service.
      type: object
      properties:
        subsNotifId:
          type: string
          description: Notification Correlation ID assigned by the NF service consumer.
        eventNotifs:
          type: array
          items:
            $ref: '#/components/schemas/SubsEventNotification'
          minItems: 1

    SubsEventNotification:
      description: >
        Contains the notification of capability of time synchronization for a list of UEs.
      type: object
      properties:
        event:
          $ref: 'TS29522_TimeSyncExposure.yaml#/components/schemas/SubscribedEvent'
        timeSyncCapas:
          type: array
          items:
            $ref: '#/components/schemas/TimeSyncCapability'
          minItems: 1
      required:
        - event

    TimeSyncCapability:
      description: Contains the capability of time synchronization service.
      type: object
      properties:
        upNodeId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint64'
        gmCapables:
          type: array
          items:
            $ref: 'TS29522_TimeSyncExposure.yaml#/components/schemas/GmCapable'
          minItems: 1
        asTimeRes:
          $ref: 'TS29522_TimeSyncExposure.yaml#/components/schemas/AsTimeResource'
        ptpCapForUes:
          type: object
          additionalProperties:
            $ref: '#/components/schemas/PtpCapabilitiesPerUe'
          minProperties: 1
          description: >
            Contains the PTP capabilities supported by each of the SUPI(s). The key of the map is
the
            SUPI.
        ptpCapForGpsis:
          type: object
          additionalProperties:
            $ref: '#/components/schemas/PtpCapabilitiesPerUe'
          minProperties: 1
          description: >
            Contains the PTP capabilities supported by each of the GPSI(s). The key of the map is
            the GPSI.
      required:
        - upNodeId
      anyOf:
        - required: [gmCapables]
        - required: [asTimeRes]

    PtpCapabilitiesPerUe:
```

```
      description: Contains the supported PTP capabilities per UE.
      type: object
      properties:
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        ptpCaps:
          type: array
          items:
            $ref: 'TS29522_TimeSyncExposure.yaml#/components/schemas/ReportedCapability'
          minItems: 1
      required:
        - ptpCaps
      oneOf:
        - required: [supi]
        - required: [gpsi]

    TimeSyncExposureConfigNotif:
      description: Contains the notification of time synchronization service state.
      type: object
      properties:
        configNotifId:
          type: string
          description: Notification Correlation ID assigned by the NF service consumer.
        stateOfConfig:
          $ref: '#/components/schemas/StateOfConfiguration'
      required:
        - configNotifId
        - stateOfConfig

    StateOfConfiguration:
      description: >
        Contains the state of the time synchronization configuration and the clock quality
        acceptance criteria result.
      type: object
      properties:
        stateNwtt:
          type: boolean
          description: >
            When any of the PTP port state(s)in NW-TT is Leader, Follower or Passive, it is
            included and set to trueto indicate the current state of the time synchronization
            configuration for the NW-TT port(s) of the PTP instance is active; when
            PTP port state isin any other case, it is included and set to false to indicate
            the state ofconfiguration for the NW-TT port(s) of the PTP instance
            is inactive. Default value is false.
        clkQltIndOfNwtt:
            $ref:
'TS29522_TimeSyncExposure.yaml#/components/schemas/AcceptanceCriteriaResultIndication'
        stateOfDstts:
          description: >
            Contains the PTP port states and the clock quality acceptance criteria result of the
            DS-TT(s).
          type: array
          items:
            $ref: '#/components/schemas/StateOfDstt'
          minItems: 1

    StateOfDstt:
      description: Contains the PTP port state of a DS-TT.
      type: object
      properties:
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        state:
          type: boolean
          description: >
            When the PTP port state is Leader, Follower or Passive, it is included and set to true
            to indicate the state of configuration for DS-TT port is active; when PTP port state is
            in any other case, it is included and set to false to indicate the state of
            configuration for DS-TT port is inactive. Default value is false.
        clkQltIndOfDstt:
            $ref:
'TS29522_TimeSyncExposure.yaml#/components/schemas/AcceptanceCriteriaResultIndication'
      required:
        - state
```

```
      oneOf:
        - required: [supi]
        - required: [gpsi]

    TimeSyncExposureConfig:
      description: Contains the Time Synchronization Configuration parameters.
      type: object
      properties:
        upNodeId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint64'
        reqPtpIns:
          $ref: '#/components/schemas/PtpInstance'
        gmEnable:
          type: boolean
          description: >
            Indicates that the AF requests 5GS to act as a grandmaster for PTP or gPTP if it is
            included and set to true.
        gmPrio:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        timeDom:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        timeSyncErrBdgt:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        configNotifId:
          type: string
          description: Notification Correlation ID assigned by the NF service consumer.
        configNotifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        tempValidity:
          $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/TemporalValidity'
        covReq:
          type: array
          description: >
            Identifies a list of Tracking Areas per serving network where time
            synchronization service configuration is allowed.
          items:
            $ref:
'TS29534_Npcf_AMPolicyAuthorization.yaml#/components/schemas/ServiceAreaCoverageInfo'
          minItems: 1
        clkQltDetLvl:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ClockQualityDetailLevel'
        clkQltAcptCri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ClockQualityAcceptanceCriterion'
      required:
        - upNodeId
        - reqPtpIns
        - timeDom
        - configNotifId
        - configNotifUri

    PtpInstance:
      description: Contains PTP instance configuration and activation requested by the AF.
      type: object
      properties:
        instanceType:
          $ref: 'TS29522_TimeSyncExposure.yaml#/components/schemas/InstanceType'
        protocol:
          $ref: 'TS29522_TimeSyncExposure.yaml#/components/schemas/Protocol'
        ptpProfile:
            type: string
        portConfigs:
          type: array
          items:
            $ref: '#/components/schemas/ConfigForPort'
          minItems: 1
      required:
        - instanceType
        - protocol
        - ptpProfile

    ConfigForPort:
      description: Contains configuration for each port.
      type: object
      properties:
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
```

```
        n6Ind:
          type: boolean
          enum:
            - true
        ptpEnable:
          type: boolean
        logSyncInter:
          type: integer
        logSyncInterInd:
          type: boolean
        logAnnouInter:
          type: integer
        logAnnouInterInd:
          type: boolean
      oneOf:
        - required: [supi]
        - required: [gpsi]
        - required: [n6Ind]
```

A.3 Ntsctsf_QoSandTSCAssistance API

```
openapi: 3.0.0

info:
  title: Ntsctsf_QoSandTSCAssistance Service API
  version: 1.1.0
  description: |
    TSCTSF QoS and TSC Assistance Service.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 29.565 V18.6.0; 5G System; Time Sensitive Communication and Time Synchronization
function
    Services; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.565/'

servers:
  - url: '{apiRoot}/ntsctsf-qos-tscai/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:
  - {}
  - oAuth2ClientCredentials:
    - ntsctsf-qos-tscai

paths:
  /tsc-app-sessions:
    post:
      summary: Creates a new Individual TSC Application Session Context resource
      operationId: PostTSCAppSessions
      tags:
        - TSC Application Sessions (Collection)
      requestBody:
        description: Contains the information for the creation the resource.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TscAppSessionContextData'
      responses:
        '201':
          description: Successful creation of the resource.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TscAppSessionContextData'
          headers:
            Location:
              description: >
                Contains the URI of the created individual TSC application session context resource,
                according to the structure
```

```
              {apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId} or the
              URI of the created events subscription sub-resource, according to the structure
              {apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/
              events-subscription}
            required: true
            schema:
              type: string
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          description: Forbidden
          content:
            application/problem+json:
              schema:
                $ref: '#/components/schemas/ProblemDetailsTsctsfQosTscac'
          headers:
            Retry-After:
              description: >
                Indicates the time the AF has to wait before making a new request. It can be a
                non-negative integer (decimal number) indicating the number of seconds the AF
                has to wait before making a new request or an HTTP-date after which the AF can
                retry a new request.
              schema:
                type: string
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        terminationRequest:
          '{$request.body#/notifUri}/terminate':
            post:
              requestBody:
                description: >
                  Request of the termination of the Individual TSC Application Session Context
                required: true
                content:
                  application/json:
                    schema:
                      $ref:
'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/TerminationInfo'
              responses:
                '204':
                  description: The receipt of the notification is acknowledged.
                '307':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/307'
                '308':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/308'
                '400':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                '401':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                '403':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                '404':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                '411':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                '413':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                '415':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/415'
```

```
              '429':
                $ref: 'TS29571_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29571_CommonData.yaml#/components/responses/500'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      eventNotification:
        '{$request.body#/evSubsc/notifUri}/notify':
          post:
            requestBody:
              description: Notification of an event occurrence in the TSCTSF.
              required: true
              content:
                application/json:
                  schema:
                    $ref: '#/components/schemas/EventsNotification'
            responses:
              '204':
                description: The receipt of the notification is acknowledged.
              '307':
                $ref: 'TS29571_CommonData.yaml#/components/responses/307'
              '308':
                $ref: 'TS29571_CommonData.yaml#/components/responses/308'
              '400':
                $ref: 'TS29571_CommonData.yaml#/components/responses/400'
              '401':
                $ref: 'TS29571_CommonData.yaml#/components/responses/401'
              '403':
                $ref: 'TS29571_CommonData.yaml#/components/responses/403'
              '404':
                $ref: 'TS29571_CommonData.yaml#/components/responses/404'
              '411':
                $ref: 'TS29571_CommonData.yaml#/components/responses/411'
              '413':
                $ref: 'TS29571_CommonData.yaml#/components/responses/413'
              '415':
                $ref: 'TS29571_CommonData.yaml#/components/responses/415'
              '429':
                $ref: 'TS29571_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29571_CommonData.yaml#/components/responses/500'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /tsc-app-sessions/{appSessionId}:
    get:
      summary: Reads an existing Individual TSC Application Session Context
      operationId: GetTSCAppSession
      tags:
        - Individual TSC Application Session Context (Document)
      parameters:
        - name: appSessionId
          description: String identifying the resource.
          in: path
          required: true
          schema:
            type: string
      responses:
        '200':
          description: A representation of the resource is returned.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TscAppSessionContextData'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
```

```
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '406':
        $ref: 'TS29571_CommonData.yaml#/components/responses/406'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  patch:
    summary: Modifies an existing Individual TSC Application Session Context
    operationId: ModAppSession
    tags:
      - Individual TSC Application Session Context (Document)
    parameters:
      - name: appSessionId
        description: String identifying the resource.
        in: path
        required: true
        schema:
          type: string
    requestBody:
      description: Modification of the resource.
      required: true
      content:
        application/merge-patch+json:
          schema:
            $ref: '#/components/schemas/TscAppSessionContextUpdateData'
    responses:
      '200':
        description: >
          successful modification of the resource and a representation of that resource is
          returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TscAppSessionContextData'
      '204':
        description: The successful modification.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        description: Forbidden
        content:
          application/problem+json:
            schema:
              $ref: '#/components/schemas/ProblemDetailsTsctsfQosTscac'
        headers:
          Retry-After:
            description: >
              Indicates the time the AF has to wait before making a new request. It can be a
              non-negative integer (decimal number) indicating the number of seconds the AF
              has to wait before making a new request or an HTTP-date after which the AF can
              retry a new request.
            schema:
              type: string
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
```

```
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        eventNotification:
          '{$request.body#/evSubsc/notifUri}/notify':
            post:
              requestBody:
                description: Notification of an event occurrence in the TSCTSF.
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/EventsNotification'
              responses:
                '204':
                  description: The receipt of the notification is acknowledged.
                '307':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/307'
                '308':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/308'
                '400':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                '401':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                '403':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                '404':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                '411':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                '413':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                '415':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/415'
                '429':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/429'
                '500':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/500'
                '502':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/502'
                '503':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                default:
                  $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /tsc-app-sessions/{appSessionId}/delete:
    post:
      summary: Deletes an existing Individual TSC Application Session Context
      operationId: DeleteTSCAppSession
      tags:
        - Individual TSC Application Session Context (Document)
      parameters:
        - name: appSessionId
          description: String identifying the Individual TSC Application Session Context resource.
          in: path
          required: true
          schema:
            type: string
      requestBody:
        description: >
          Deletion of the Individual TSC Application Session Context resource, request notification.
        required: false
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/EventsSubscReqData'
      responses:
        '200':
          description: The deletion of the resource is confirmed and a resource is returned
          content:
            application/json:
```

```
            schema:
              $ref: '#/components/schemas/EventsNotification'
      '204':
        description: The deletion is confirmed without returning additional data.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
/tsc-app-sessions/{appSessionId}/events-subscription:
  put:
    summary: Creates or modifies an Events Subscription subresource
    operationId: putEventsSubsc
    tags:
      - Events Subscription (Document)
    parameters:
      - name: appSessionId
        description: String identifying the Events Subscription resource
        in: path
        required: true
        schema:
          type: string
    requestBody:
      description: Creation or modification of an Events Subscription resource.
      required: true
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/EventsSubscReqData'
    responses:
      '201':
        description: >
          The creation of the Events Subscription resource is confirmed and its representation is
          returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/EventsSubscReqData'
        headers:
          Location:
            description: >
              Contains the URI of the created Events Subscription resource,
              according to the structure
              {apiRoot}/ntsctsf-qos-tscai/<apiVersion>/tsc-app-sessions/{appSessionId}/
              events-subscription}
            required: true
            schema:
              type: string
      '200':
        description: >
          The modification of the Events Subscription resource is confirmed and its representation
          is returned.
        content:
          application/json:
            schema:
```

```
              $ref: '#/components/schemas/EventsSubscReqData'
        '204':
          description: >
            The modification of the Events Subscription subresource is confirmed without returning
            additional data.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        eventNotification:
          '{$request.body#/notifUri}/notify':
            post:
              requestBody:
                description: >
                  Contains the information for the notification of an event occurrence in the
TSCTSF.
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/EventsNotification'
              responses:
                '204':
                  description: The receipt of the notification is acknowledged.
                '307':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/307'
                '308':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/308'
                '400':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                '401':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                '403':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                '404':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                '411':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                '413':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                '415':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/415'
                '429':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/429'
                '500':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/500'
                '502':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/502'
                '503':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                default:
                  $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    delete:
```

```
      summary: Deletes the Events Subscription subresource.
      operationId: DeleteEventsSubsc
      tags:
        - Events Subscription (Document)
      parameters:
        - name: appSessionId
          description: String identifying the Individual TSC Application Session Context resource
          in: path
          required: true
          schema:
            type: string
      responses:
        '204':
          description: >
            The deletion of the of the Events Subscription sub-resource is confirmed without
returning
            additional data.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            ntsctsf-qos-tscai: Access to the Ntsctsf_QoSandTSCAssistance API

  schemas:
    TscAppSessionContextData:
      description: Represents an Individual TSC Application Session Context resource.
      type: object
      required:
        - notifUri
        - afId
        - qosReference
      allOf:
        - oneOf:
          - required: [ueIpAddr]
          - required: [ueMac]
          - required: [ueId]
          - required: [externalGroupId]
        - not:
            required: [ethFlowInfo, enEthFlowInfo]
        - not:
            required: [altQosReqs, altQosReferences]
      properties:
        ueIpAddr:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/IpAddr'
        ipDomain:
          type: string
          description: The IPv4 address domain identifier.
        ueMac:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/MacAddr48'
        ueId:
```

```
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        externalGroupId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ExternalGroupId'
        dnn:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Dnn'
        snssai:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Snssai'
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        appId:
          type: string
          description: Identifies the Application Identifier.
        ethFlowInfo:
          type: array
          items:
            $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
          minItems: 1
        enEthFlowInfo:
          type: array
          items:
            $ref: 'TS29122_CommonData.yaml#/components/schemas/EthFlowInfo'
          minItems: 1
          description: >
            Identifies the Ethernet flows which require QoS. Each Ethernet flow consists of a flow
            identifer and the corresponding UL and/or DL flows.
        flowInfo:
          type: array
          items:
            $ref: 'TS29122_CommonData.yaml#/components/schemas/FlowInfo'
          minItems: 1
        afId:
          type: string
          description: Identifies the AF identifier.
        tscQosReq:
          $ref: 'TS29122_AsSessionWithQoS.yaml#/components/schemas/TscQosRequirement'
        qosReference:
          type: string
          description: Identifies a pre-defined QoS information.
        altQosReferences:
          type: array
          items:
            type: string
          minItems: 1
          description: Identifies an ordered list of pre-defined QoS information.
        altQosReqs:
          type: array
          items:
            $ref:
'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/AlternativeServiceRequirementsData'
          minItems: 1
          description: >
            Identifies an ordered list of alternative service requirements that include individual
            QoS parameter sets. The lower the index of the array for a given entry, the higher the
            priority.
        aspId:
          $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/AspId'
        sponId:
          $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/SponId'
        sponStatus:
          $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/SponsoringStatus'
        evSubsc:
          $ref: '#/components/schemas/EventsSubscReqData'
        tempInValidity:
          $ref: '#/components/schemas/TemporalInValidity'
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'

    TscAppSessionContextUpdateData:
      description: >
        Describes the authorization data of an Individual TSC Application Session Context created by
        the PCF.
      type: object
      properties:
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        appId:
          type: string
          description: Identifies the Application Identifier.
```

```
        ethFlowInfo:
          type: array
          items:
            $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/EthFlowDescription'
          minItems: 1
        enEthFlowInfo:
          type: array
          items:
            $ref: 'TS29122_CommonData.yaml#/components/schemas/EthFlowInfo'
          minItems: 1
          description: >
            Identifies the Ethernet flows which require QoS. Each Ethernet flow consists of a flow
            identifer and the corresponding UL and/or DL flows.
        flowInfo:
          type: array
          items:
            $ref: 'TS29122_CommonData.yaml#/components/schemas/FlowInfo'
          minItems: 1
        tscQosReq:
          $ref: 'TS29122_AsSessionWithQoS.yaml#/components/schemas/TscQosRequirementRm'
        qosReference:
          type: string
          description: Identifies a pre-defined QoS information.
        altQosReferences:
          type: array
          items:
            type: string
          minItems: 1
          description: Identifies an ordered list of pre-defined QoS information.
        altQosReqs:
          type: array
          items:
            $ref:
'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/AlternativeServiceRequirementsData'
          minItems: 1
          description: >
            Identifies an ordered list of alternative service requirements that include individual
            QoS parameter sets. The lower the index of the array for a given entry, the higher the
            priority.
        aspId:
          $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/AspId'
        sponId:
          $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/SponId'
        sponStatus:
          $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/SponsoringStatus'
        evSubsc:
          $ref: '#/components/schemas/EventsSubscReqDataRm'
        tempInValidity:
          $ref: '#/components/schemas/TemporalInValidity'

    EventsSubscReqData:
      description: Identifies the events the application subscribes to.
      type: object
      required:
        - events
        - notifUri
        - notifCorreId
      properties:
        events:
          type: array
          items:
            $ref: '#/components/schemas/TscEvent'
          minItems: 1
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        qosMon:
          $ref: 'TS29122_AsSessionWithQoS.yaml#/components/schemas/QosMonitoringInformation'
        usgThres:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/UsageThreshold'
        notifCorreId:
          type: string

    EventsSubscReqDataRm:
      description: >
        This data type is defined in the same way as the EventsSubscReqData data type, but with the
        OpenAPI nullable property set to true.
      type: object
      required:
```

```
      - events
    properties:
      events:
        type: array
        items:
          $ref: '#/components/schemas/TscEvent'
        minItems: 1
      notifUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      qosMon:
        $ref: 'TS29122_AsSessionWithQoS.yaml#/components/schemas/QosMonitoringInformationRm'
      usgThres:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/UsageThresholdRm'
      notifCorreId:
        type: string
    nullable: true

  EventsNotification:
    description: Describes the notification of matched events.
    type: object
    required:
      - notifCorreId
      - events
    properties:
      notifCorreId:
        type: string
      events:
        type: array
        items:
          $ref: '#/components/schemas/EventNotification'
        minItems: 1

  EventNotification:
    description: Describes a notification of an matched event.
    type: object
    required:
      - event
    properties:
      event:
        $ref: '#/components/schemas/TscEvent'
      flowIds:
        type: array
        items:
          type: integer
        minItems: 1
        description: Identifies the IP flows that were sent during event subscription.
      qosMonReports:
        type: array
        items:
          $ref: 'TS29122_AsSessionWithQoS.yaml#/components/schemas/QosMonitoringReport'
        minItems: 1
      usgRep:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/AccumulatedUsage'
      appliedQosRef:
        type: string
        description: >
          The currently applied alternative QoS requirement referring to an alternative QoS
          reference or a requested alternative QoS parameter set. Applicable for
          event QOS_NOT_GUARANTEED or SUCCESSFUL_RESOURCES_ALLOCATION.
      altQosNotSuppInd:
        type: boolean
        description: >
          When present and set to true it indicates that the Alternative QoS profiles are not
          supported by NG-RAN. Applicable for
          event QOS_NOT_GUARANTEED or SUCCESSFUL_RESOURCES_ALLOCATION.
      batOffsetInfo:
        $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/BatOffsetInfo'

  AdditionalInfoTsctsfQosTscac:
    description: Describes additional error information specific for this API.
    type: object
    properties:
      acceptableServInfo:
        $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/AcceptableServiceInfo'

  TemporalInValidity:
    description: >
      Represents the temporal invalidity conditions, i.e., the time interval(s) during
```

```
        which the AF request is not to be applied.
      type: object
      properties:
        startTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        stopTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      required:
        - startTime
        - stopTime

#
# ENUMERATIONS DATA TYPES
#
    TscEvent:
      description: Represents an event to notify to the AF.
      anyOf:
      - type: string
        enum:
          - FAILED_RESOURCES_ALLOCATION
          - QOS_MONITORING
          - QOS_GUARANTEED
          - QOS_NOT_GUARANTEED
          - SUCCESSFUL_RESOURCES_ALLOCATION
          - USAGE_REPORT
          - BAT_OFFSET_INFO
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          and is not used to encode content defined in the present version of this API.
#
# ALTERNATIVE DATA TYPES OR COMBINATIONS OF DATA TYPES
#
    ProblemDetailsTsctsfQosTscac:
      description: Extends ProblemDetails to also include the acceptable service info.
      allOf:
      - $ref: 'TS29571_CommonData.yaml#/components/schemas/ProblemDetails'
      - $ref: '#/components/schemas/AdditionalInfoTsctsfQosTscac'
```

A.4 Ntsctsf_ASTI API

```
openapi: 3.0.0

info:
  title: Ntsctsf_ASTI Service API
  version: 1.1.0
  description: |
    TSCTSF  Access Stratum time distribution configuration Service.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 29.565 V18.6.0; 5G System; Time Sensitive Communication and
    Time Synchronization Function Services; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.565/'

servers:
  - url: '{apiRoot}/ntsctsf-asti/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:
  - {}
  - oAuth2ClientCredentials:
    - ntsctsf-asti

paths:
  /configurations:
    post:
      summary: Creates a new Individual ASTI Configuration resource.
      operationId: ASTIConfiguration
      tags:
```

```
    - ASTI Configurations (Collection)
  requestBody:
    description: Contains the information for the creation the resource.
    required: true
    content:
      application/json:
        schema:
          $ref: '#/components/schemas/AccessTimeDistributionData'
  responses:
    '201':
      description: Successful creation of the resource.
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/AccessTimeDistributionData'
      headers:
        Location:
          description: >
            Contains the URI of the created individual ASTI Configuration resource,
            according to the structure
            {apiRoot}/ntsctsf-asti/<apiVersion>/configurations/{configId}
          required: true
          schema:
            type: string
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '502':
      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    astiNotification:
      '{$request.body#/astiNotifUri}':
        post:
          requestBody:
            description: Notification of an ASTI configuration change event.
            required: true
            content:
              application/json:
                schema:
                  $ref: '#/components/schemas/AstiConfigNotification'
          responses:
            '204':
              description: The receipt of the notification is acknowledged.
            '307':
              $ref: 'TS29571_CommonData.yaml#/components/responses/307'
            '308':
              $ref: 'TS29571_CommonData.yaml#/components/responses/308'
            '400':
              $ref: 'TS29571_CommonData.yaml#/components/responses/400'
            '401':
              $ref: 'TS29571_CommonData.yaml#/components/responses/401'
            '403':
              $ref: 'TS29571_CommonData.yaml#/components/responses/403'
            '404':
              $ref: 'TS29571_CommonData.yaml#/components/responses/404'
            '411':
              $ref: 'TS29571_CommonData.yaml#/components/responses/411'
            '413':
              $ref: 'TS29571_CommonData.yaml#/components/responses/413'
```

```
              '415':
                $ref: 'TS29571_CommonData.yaml#/components/responses/415'
              '429':
                $ref: 'TS29571_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29571_CommonData.yaml#/components/responses/500'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'


/configurations/retrieve:
  post:
    summary: Request the status of the 5G access stratum time distribution for a list of UEs.
    operationId: RequestStatusof5GAccessStratumTimeDistribution
    tags:
      - ASTI Configurations
    requestBody:
      description: >
        Contains the information for the status of the 5G access stratum time distribution.
      required: true
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/StatusRequestData'
    responses:
      '200':
        description: >
          Successful retrieval of the status of the 5G access stratum time distribution.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/StatusResponseData'
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'

/configurations/{configId}:
  put:
    summary: Modifies an existing Individual ASTI Configuration resource.
    operationId: ModifyIndividualASTIConfiguration
    tags:
      - Individual ASTI Configuration (Document)
    parameters:
      - name: configId
        description: String identifying an Individual ASTI Configuration.
        in: path
        required: true
        schema:
          type: string
```

```
    requestBody:
      required: true
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/AccessTimeDistributionData'
    responses:
      '200':
        description: OK. Resource was succesfully modified and representation is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AccessTimeDistributionData'
      '204':
        description: No Content. Resource was succesfully modified.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  delete:
    operationId: DeleteIndividualASTIConfiguration
    summary: Delete an Individual ASTI Configuration
    tags:
      - Individual ASTI Configuration (Document)
    parameters:
      - name: configId
        in: path
        description: String identifying an Individual ASTI Configuration.
        required: true
        schema:
          type: string
    responses:
      '204':
        description: No Content. Resource was successfully deleted.
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
```

```
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            ntsctsf-asti: Access to the Ntsctsf_ASTI API

  schemas:
    AccessTimeDistributionData:
      description: >
        Contains the parameters for the creation of 5G access stratum time distribution
        configuration.
      type: object
      properties:
        supis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
          minItems: 1
        gpsis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
          minItems: 1
        interGrpId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/GroupId'
        exterGrpId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ExternalGroupId'
        asTimeDisParam:
          $ref: '#/components/schemas/AfAsTimeDistributionParam'
        covReq:
          type: array
          description: >
            Identifies a list of Tracking Areas per serving network where 5GS
            Access Stratum Time Distribution parameters are allowed.
          items:
            $ref:
'TS29534_Npcf_AMPolicyAuthorization.yaml#/components/schemas/ServiceAreaCoverageInfo'
          minItems: 1
        astiNotifId:
          type: string
          description: Notification Correlation ID assigned by the NF service consumer.
        astiNotifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      required:
        - asTimeDisParam
      oneOf:
        - required: [supis]
        - required: [interGrpId]
        - required: [gpsis]
        - required: [exterGrpId]

    AfAsTimeDistributionParam:
      description: Contains the 5G access stratum time distribution parameters requested by the AF.
      type: object
      properties:
        asTimeDisEnabled:
          type: boolean
          description: >
            When this attribute is included and set to true, it indicates that the access stratum
            time distribution via Uu reference point is activated.
        timeSyncErrBdgt:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        tempValidity:
          $ref: 'TS29514_Npcf_PolicyAuthorization.yaml#/components/schemas/TemporalValidity'
        clkQltDetLvl:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ClockQualityDetailLevel'
        clkQltAcptCri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ClockQualityAcceptanceCriterion'
```

```
    StatusRequestData:
      description: >
        Contains the parameters for retrieval of the status of the access stratum time distribution
        for a list of UEs.
      type: object
      properties:
        supis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
          minItems: 1
        gpsis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
          minItems: 1
      oneOf:
        - required: [supis]
        - required: [gpsis]

    StatusResponseData:
      description: >
        Contains the parameters for the status of the access stratum time distribution for a list of
        UEs.
      type: object
      properties:
        inactiveUes:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
          minItems: 1
        inactiveGpsis:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
          minItems: 1
        activeUes:
          type: array
          items:
            $ref: '#/components/schemas/ActiveUe'
          minItems: 1

    ActiveUe:
      description: >
        Contains the UE identifier whose status of the access stratum time distribution is active
        and the optional requested time synchronization error budget.
      type: object
      properties:
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        timeSyncErrBdgt:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      oneOf:
        - required: [supi]
        - required: [gpsi]

    AstiConfigNotification:
      description: >
        Contains the report of a change in the 5G Access Stratum Time Distribution
        parameters applied to the UE(s).
      type: object
      properties:
        astiNotifId:
          type: string
        stateConfigs:
          type: array
          items:
            $ref: '#/components/schemas/AstiConfigStateNotification'
          minItems: 1
          description: >
            It contains the the reported event(s) and event information.
      required:
        - astiNotifId
        - stateConfigs
```

```
    AstiConfigStateNotification:
      description: >
        Contains the report of a change in the 5G Access Stratum Time Distribution
        parameters applied to a UE.
      type: object
      properties:
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        event:
          $ref: '#/components/schemas/AstiEvent'
      required:
        - event
      oneOf:
        - required: [supi]
        - required: [gpsi]
#
# ENUMERATIONS DATA TYPES
#
    AstiEvent:
      anyOf:
      - type: string
        enum:
          - ASTI_ENABLED
          - ASTI_DISABLED
          - CLOCK_QUAL_ACCEPTABLE
          - CLOCK_QUAL_NON_ACCEPTABLE
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          and is not used to encode content defined in the present version of this API.
      description: |
        Represents an ASTI event to notify to the AF/NEF.
        Possible values are:
        - ASTI_ENABLED: Access stratum time distribution via Uu reference point is activated.
        - ASTI_DISABLED: Access stratum time distribution via Uu reference point is deactivated.
        - CLOCK_QUAL_ACCEPTABLE: The UE meets the clock quality acceptance criteria.
        - CLOCK_QUAL_NON_ACCEPTABLE: The UE does not meet the clock quality acceptance criteria.
```

Annex B (normative): 3GPP extensions for DetNet integration with 5GS

B.1 3GPP extensions for DetNet integration with 5GS

B.1.1 Introduction

The 5G System is integrated with the Deterministic Networking as defined in IETF RFC 8655[63] as a logical DetNet transit node as specified in 3GPP TS 23.501 [2], clause 4.4.8.4.

The support of deterministic networking is achieved by reusing the TSC framework for deterministic QoS and time synchronization services. To enable deterministic networking in 5GS, the DetNet controller collects interface information from the 5GS DetNet node via the TSCTSF using the 5GS DetNet node information reporting procedure described in clause 5.5.12.2 of 3GPP TS 23.513 [31] and provides DetNet Yang configurations for DetNet flow(s) as described in clause 5.5.12.3 of 3GPP TS 23.513 [31].

The TSCTSF offers to the DetNet controller RESTCONF (IETF RFC 8040 [30]) and/or NETCONF (IETF RFC 6241 [29]) interfaces and the data schema defined by the 3GPP Extended Deterministic Networking (DetNet) YANG model. The 3GPP Extended DetNet YANG model is based on the DetNet YANG model specified in IETF RFC 9633 [28] and extended by 3GPP Extensions described in table B.1.1-1.

The 3GPP Extended DetNet YANG Model offered by the TSCTSF is accessed by the DetNet controller as shown in figure B.1.1-1

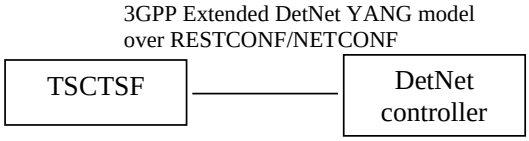

Figure B.1.1-1: Representation of the access to 3GPP Extended DetNet YANG Model.

Table B.1.1-1 summarizes the 3GPP extensions to the DetNet YANG model defined in this specification.

Table B.1.1-1: 3GPP Extensions Descriptions

3GPP Extension	Clause	Description	YANG File	Module Name	Annex
_3gpp-5gs-detnet-node	B.1.2	Enables the report of 5GS DetNet node interface information and the provisioning and configuration of data for the DetNet flows.	_3gpp-5gs-detnet-node.yang	_3gpp-5gs-detnet-node	C.2

B.1.2 3GPP Extension _3gpp-5gs-detnet-node

B.1.2.1 Description

Deterministic Networking parameter provisioning allows a DetNet controller to configure deterministic networking parameters in 5GS and provide time-sensitive features that guarantee almost zero packet loss rates and bounded latency.

The DetNet controller communicates with the 5GS system through the TSCTSF as specified in 3GPP TS 29.513 [31] to collect 5GS DetNet node interface information and to provide DetNet flow-related parameters to configure the DetNet traffic in 5GS.

The TSCTSF may receive DetNet YANG configuration for DetNet flows as described in IETF RFC 9633 [28], that describes the traffic characteristics and QoS requirements for the DetNet flows. Additionally, when both, the TSCTSF and the DetNet controller support the 3GPP Extension _3gpp-5gs-detnet-node, the configuration of the DetNet traffic in 5GS also enable that:

- The DetNet controller may provide the maximum latency and/or maximum loss requirements the 5GS system needs to apply, as specified in clause B.1.2.2.

- The TSCTSF may provide to the DetNet controller 5GS specific status code information on the status of the configuration requested by the DetNet controller for the DetNet flow(s), as specified in clause B.1.2.3.

To enable the DetNet controller builds up network topology information, the 5GS DetNet node exposes interface information to the DetNet controller through the TSCTSF. When both, the TSCTSF and the DetNet controller support the 3GPP Extension _3gpp-5gs-detnet-node, the TSCTSF may provide to the DetNet controller 5GS DetNet node identification as specified in clause B.1.2.4.

B.1.2.2 Provisioning of 5GS specific traffic characteristics and requirements

When both, the DetNet controller and the TSCTSF support the 3GPP Extension _3gpp-5gs-detnet-node, the DetNet controller may provide the following 5GS specific traffic characteristics and requirements within the "_3gpp-5gs-node-requirements" YANG container:

- the maximum latency from 5GS node ingress to 5GS node egress(es) of a DetNet flow by providing the "_3gpp-5gs-node-max-latency" attribute; and/or

- the maximum packet loss ratio parameter for the DetNet service between the 5G node ingress and the 5GS node egress(es) by providing the "_3gpp-5gs-node-max-loss" attribute; and

- a reference to the DetNet flow identification within the "forwarding-sub-layer" attribute.

When the DetNet controller does not provide the "_3gpp-5gs-node-max-latency" attribute and/or the "_3gpp-5gs-node-max-loss" attribute but instead provides the IETF RFC 9633 [28] "max-latency" and/or "max-loss" attributes for the end-to-end flow, the TSCTSF may determine the corresponding maximum latency and/or maximum packet loss values based on a preconfigured mapping and applicable to the 5GS specific deployment.

NOTE: If the DetNet controller does not include the 5GS specific "_3gpp-5gs-node-max-latency" nor the end-to-end "max-latency", the TSCTSF can derive the Requested 5GS Delay or, alternatively, the PCF can derive the PDB. Similarly, if the DetNet YANG configuration does not include the 5GS specific "_3gpp-5gs-node-max-loss" nor the end-to-end "max-loss", the TSCTSF can derive the Requested Packet Error Rate or, alternatively, the PCF can derive the PER.

B.1.2.3 Report of 5GS DetNet flow(s) status

The DetNet controller may be informed about the following 5GS specific events about status change of the configured DetNet flows:

- Notification about DetNet flow(s) deactivation in 5GS node. To notify the DetNet controller about DetNet flow deactivation in 5GS, the TSCTSF shall subscribe with the PCF to service data flow deactivation as specified in 3GPP TS 29.514 [20].

- Notification about resource allocation outcome in 5GS node. The TSCTSF shall subscribe with the PCF to notifications about the unsuccessful and/or successful resource allocation outcome as specified in 3GPP TS 29.514 [20].

- Notification about PDU session release.

When the TSCTSF receives from the PCF the notification about service data flow deactivation, or the notification about unsuccessful or successful resource allocation, or the notification about PDU session release and both, the DetNet

controller and the TSCTSF support the 3GPP Extension _3gpp-5gs-detnet-node, the TSCTSF may notify the DetNet controller by including the following 3GPP 5GS specific failure reason:

- "_3gpp-5gs-node-resource-allocation-failure", to notify about the failed resource allocation in the 5G System;
- "_3gpp-5gs-node-resource-allocation-success", to notify about the successful resource allocation in the 5G System; or
- "_3gpp-5gs-node-pdu-session-release", to notify about PDU session release.

When the TSCTSF or the DetNet controller do not support the 3GPP Extension _3gpp-5gs-detnet-node, the TSCTSF provides an IETF RFC 9633 [28] defined failure-reason, e.g. "resource-unavailable".

B.1.2.4 Exposure of 5GS DetNet Node Identification

The TSCTSF collects 5GS DetNet node interface information from the NW-TT/UPF using Time Synchronization procedures as described in 3GPP TS 29.513[31]. When both, the TSCTSF and the DetNet controller support the 3GPP Extension _3gpp-5gs-detnet-node, the TSCTSF may provide to the DetNet controller 5GS DetNet node identification.

During PDU session establishment, i.e., when the TSCTSF receives the Npcf_PolicyAuthorization_Notify service operation defined in clause 4.2.5.16 of 3GPP TS 29.514 [20], the TSCTSF may use the received user-plane node Id to generate an identifier of the 5GS DetNet node and provide it to the DetNet controller within the "_3gpp-5gs-node-id" attribute.

B.2 YANG Module Definitions

B.2.1 Introduction

B.2.1.1 General

As specified in IETF RFC 7590 [33], a YANG model is defined in a YANG module and is stored in a file with file extension ".yang". An extension to an existing YANG model is done via the definition of a new YANG module that contains the definitions of the new components.

A YANG module typically has the following layout:

```
module <module-name> {

  // header information
  <yang-version statement>
  <namespace statement>
  <prefix statement>

  // linkage statements
  <import statements>
  <include statements>

  // meta-information
  <organization statement>
  <contact statement>
  <description statement>
  <reference statement>

  // revision history
  <revision statements>

  // module definitions
  <other statements>
}
```

The YANG module with the 3GPP extensions for the DetNet YANG model shall follow the YANG model layout defined in clause 7.1 of IETF RFC 7590 [33] and represented above, where the `linkage` and `module definitions` statements contain the definition of the new components that represent the 5GS specifics.

B.2.1.2 Module name

```
module <module-name>
```

To differentiate from other YANG modules, 3GPP extensions to DetNet YANG model module(s) shall start with the "_3gpp-5gs-detnet" prefix.

B.2.1.3 Header information

B.2.1.3.1 <yang-version statement>

According to IETF RFC 7590 [33], YANG version 1.1 shall be used.

B.2.1.3.2 <namespace statement>

The namespace for a YANG module's namespace shall follow section 4.9 of IETF RFC 8407.

The 3GPP extensions to DetNet YANG model shall follow the following form:

```
urn:3gpp:node:detnet:<module-name>
```

B.2.1.3.3 <prefix statement>

To ensure uniqueness of the prefix defined in the 3GPP extensions for the DetNet YANG model, the module(s) shall use prefixes ending with "3gppdnet". Prefixes should be short preferably not longer than 10 characters, but 13 characters at most.

B.2.1.4 Meta-information

B.2.1.4.1 <organization statement>

The organization statement shall contain the organization developing and maintaining the YANG file with the 3GPP extensions for the DetNet YANG model, i.e. the string "3GPP CT3 Working Group".

B.2.1.4.2 <contact statement>

The contact statement contains contact information for the person or persons to whom technical queries concerning this module should be sent.

For the 3GPP extensions to YANG DetNet model it shall include a string with the CT3 WG web link.

```
contact
  "CT3 WG Web:  <https://www.3gpp.org/3gpp-groups/core-network-terminals-ct/ct-wg3>";
```

B.2.1.4.3 <description statement>

The description statement contains human-readable textual description for the module definition.

In addition, the YANG module with 3GPP extensions to YANG DetNet model shall also include the copyright notice as included in the front page of the present document and a reference to the present document.

EXAMPLE:

```
description
  "_3gpp-5gs-detnet-node module contains an extension of ietf-detnet YANG module with
  additional parameters defined for interworking with 3GPP 5GS.

  © 2023, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
  All rights reserved.
```

```
  This version of this YANG module is specified in:
  3GPP TS 29.565 V18.5.0; 5G System;
    Time Sensitive Communication and Time Synchronization Function Services.
  url: http://www.3gpp.org/ftp/Specs/archive/29_series/29.565/";
```

B.2.1.4.4 <reference statement>

This statement contains a human-readable cross reference to an external document that defines related information or additional information.

When included, it refers e.g., to other 3GPP Technical Specifications with related information.

EXAMPLE:

```
reference
  "Additional information to this YANG module is specified in:
    3GPP TS 23.501, System architecture for the 5G System (5GS)
    3GPP TS 23.502, Procedures for the 5G System (5GS)
    3GPP TS 23.503, Policy and charging control framework (5GS)
  url: http://www.3gpp.org/ftp/Specs/archive/23_series/";
```

B.2.1.4.5 <revision statement>

This statement contains the revision history of the module, including the initial revision. A series of `revision` statements detail the changes in the module's definition. The argument is a date string in the format "YYYY-MM-DD" followed by a block of sub-statements with detailed revision information. A module should have at least one `revision` statement.

For the YANG module(s) with the 3GPP extensions to YANG DetNet model:

1. For a frozen release, only one revision statement shall be included and shall indicate the last revision of the module for that release version of the TS.
2. A non-frozen release may contain a series of revision statements that represent the list of changes approved in that release. At the freeze of the release, only the last revision statement shall be kept.
3. The date argument of the revision statement(s) shall contain a value corresponding to the CT plenary date that approved the latest changes to the YANG module.
4. To allow the YANG module could be updated with new components in new releases or with corrections in a frozen release, a version control mechanism is enabled. The description sub-statement shall be used to contain a string with the YANG module version. Version control for the 3GPP Extensions for the DetNet YANG shall follow the version control rules for SBI APIs specified in 3GPP TS 29.501 [5], clause 4.3.

EXAMPLE 1: Series of revision published by 3GPP of the 3GPP extension YANG module before the freeze of the Rel-18, with version included.

```
revision 2023-12-dd
// optional
{
  description "version: v1.0.0-alpha.3"};

revision 2023-09-dd
// optional
{
  description "version: v1.0.0-alpha.2"};

revision 2023-06-dd
// optional
{
  description "version: v1.0.0-alpha.1"};
```

EXAMPLE 2: Final revision of the 3GPP extension of the YANG module published by 3GPP, with version included, published at the freeze of Rel-18.

```
revision 2024-06-dd
{
  description "version: v1.0.0"};
```

EXAMPLE 3: The YANG module is evolved during the first plenary cycle corresponding to Rel-19.

```
revision 2024-09-dd
{
  description "version: v1.1.0-alpha.1"};
```

B.2.1.2 Formatting rules

The following 3GPP specific guidelines should be used when documenting the YANG module for the 3GPP extensions to the DetNet YANG model:

- The YANG module should be considered a code component. The strings "<CODE BEGINS>" and "<CODE ENDS>" are used to identify each code component.
- The "<CODE BEGINS>" tag is followed by a string identifying the file name as specified in section 5.2 of IETF RFC 6020 [35].
- The YANG data nodes (leaf, leaf-list, container, list) shall be used for data modelling of the new YANG components.
- The style used for the specification of the YANG module shall be "PL" (Programming Language).
- Comments may be added by following the standard YANG 1.1 syntax ("//" or "/*" and "*/").
- Tabs shall not be used (e.g. within description fields).
- "Unbreakable" spaces (UTF-8 'NO-BREAK SPACE' (U+00A0)) shall not be used (e.g. within description fields). Only "normal" spaces (UTF-8 'SPACE' (U+0020)) shall be allowed.
- Trailing spaces (i.e. white spaces at the end of a line) should not be used.

B.2.2 _3gpp-5gs-detnet-node Module definition

B.2.2.1 Introduction

The 3GPP extension to the IETF RFC 9633 [28] is defined in 3GPP as a YANG module which imports IETF RFC 9633 [28] and adds the 3GPP specific parameters.

The module name shall be set to "_3gpp-5gs-detnet-node".

The YANG version shall be set to "1.1".

The namespace for the _3gpp-5gs-detnet-node YANG module shall be set to "urn:3gpp:node:detnet:_3gpp-5gs-detnet-node".

The prefix statement for the _3gpp-5gs-detnet-node YANG module shall be set to "_5gs3gppdnet".

B.2.2.2 Data Model

B.2.2.2.1 General

Table B.2.2.2.1-1 specifies the data types defined for the _3gpp-5gs-detnet-node Module.

Table B.2.2.2.1-1: _3gpp-5gs-detnet-node Module specific Data Types

Data type	Clause defined	Description	Applicability
_3gpp-5gs-node-configuration-outcome	B.2.2.2.2.3	It is a container that represents the additional outcome the 5GS may provide to a configuration request.	
_3gpp-5gs-node-configuration-status	B.2.2.2.3.3	It is an enumeration that represents the 3GPP specific configuration status that may be reported by the 5GS node.	
_3gpp-5gs-node-identity	B.2.2.2.2.4	It is a container that represents the user-plane node Id handling the traffic of the reported DetNet flows/PDU session.	
_3gpp-5gs-node-requirements	B.2.2.2.2.2	It is a container that represents the maximum delay and/or the maximum loss the 5GS needs to satisfy for the traffic of the DetNet flows indicated by the forwarding sublayer.	

Table B.2.2.2.1-2 specifies data types re-used by the _3gpp-5gs-detnet-node Module from other YANG modules, including a reference to their respective specifications and when needed, a short description of their use.

Table BA.2.2.2.1-2: _3gpp-5gs-detnet-node Module re-used Data Types

Data type	Reference	Comments	Applicability
forwarding-sub-layer-ref	IETF RFC 9633 [28]	Contains a reference to the forwarding sublayer as specified in IETF RFC 9633 YANG module.	

B.2.2.2.2 Structured data types

B.2.2.2.2.1 Introduction

This clause defines the YANG structures to be used in _3gpp-5gs-detnet-node YANG Module.

B.2.2.2.2.2 Type: _3gpp-5gs-node-requirements

The _3gpp-5gs-node-requirements type is a YANG container that defines the maximum delay and/or the maximum loss the 5GS needs to satisfy for the traffic of the DetNet flows indicated by the forwarding sublayer.

Table B.2.2.2.2.2-1: Definition of type _3gpp-5gs-node-requirements

Attribute name	Data type	P	Cardinality	Description
forwarding-sub-layer	forwarding-sub-layer-ref	M	1	The forwarding-sublayer leaf contains a reference to the forwarding sub-layer that the maximum delay and/or the maximum loss applies to.
_3gpp-5gs-node-max-latency	uint32	O	0..1	The _3gpp-5gs-node-max-latency leaf contains the maximum latency from 5GS node ingress to 5GS node egress(es) for a single packet of the DetNet flow. It is specified as an integer number of nanoseconds.
_3gpp-5gs-node-max-loss	uint32	O	0..1	The _3gpp-5gs-node-max-loss leaf contains the maximum Packet Loss Ratio (PLR) parameeter for the DetNet service between the 5GS node ingress and the 5GS node egress(es).

B.2.2.2.2.3 Type: _3gpp-5gs-node-configuration-outcome

The _3gpp-5gs-node-configuration-outcome type is a YANG container that defines the additional outcome the 5GS may provide to a configuration request for the DetNet flows comprised by the forwarding sublayer.

Table B.2.2.2.2.3-1: Definition of type _3gpp-5gs-node-configuration-outcome

Attribute name	Data type	P	Cardinality	Description
forwarding-sub-layer	forwarding-sub-layer-ref	M	1	The forwarding-sublayer leaf contains a reference to the forwarding sub-layer that the reported configuration status applies to.
_3gpp-5gs-node-configuration-status	_3gpp-5gs-node-configuration-status	O	0..1	The _3gpp-5gs-node-configuration-status leaf contains 3GPP specific configuration status codes that may be reported by the 3GPP 5GS node.

B.2.2.2.2.4 Type: _3gpp-5gs-node-identity

The _3gpp-5gs-node-identity type is a YANG container that defines the 5GS node identity handling the traffic of the DetNet flows comprised by the forwarding sublayer.

Table B.2.2.2.2.3-1: Definition of type _3gpp-5gs-node-configuration-outcome

Attribute name	Data type	P	Cardinality	Description
forwarding-sub-layer	forwarding-sub-layer-ref	M	1	The forwarding-sublayer leaf contains a reference to the forwarding sub-layer the _3gpp-5gs-node-Id applies to.
_3gpp-5gs-node-id	string	O	0..1	The _3gpp-5gs-node-id leaf contains 3GPP 5GS node identity (DetNet router identity).

B.2.2.2.3 Simple data types and enumerations

B.2.2.2.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

B.2.2.2.3.2 Simple data types

The simple data types defined in table B.2.2.2.3.2-1 shall be supported.

Table B.2.2.2.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability
	<one simple data type >		

B.2.2.2.3.3 Enumeration: _3gpp-5gs-node-configuration-status

The enumeration _3gpp-5gs-node-configuration-status represents the configuration status that may be reported by the 3GPP 5GS node. It shall comply with the provisions defined in table B.2.2.2.3.3-1.

Table B.2.2.2.3.3-1: Enumeration _3gpp-5gs-node-configuration-status

Enumeration value	Description	Applicability
_3gpp-5gs-node-resource-allocation-success	Successful resource allocation within 5GS for the requested configuration.	
_3gpp-5gs-node-resource-allocation-failure	Failed resource allocation within 5GS for the requested configuration.	
_3gpp-5gs-node-port-release	Port release due to the termination of PDU session with the requested 5GS configuration.	

Annex C (normative): YANG module specification

C.1 General

The present Annex contains the YANG file for the _3gpp-5gs-detnet-node YANG module, that specifies the 3GPP extensions to support:

- The indication of the maximum loss and maximumd latency the 5GS system shall apply for the provided DetNet flows.
- 5GS specific status codes with information about the status of the configuration requested by the DetNet controller.
- Exposure of 5GS DetNet node identification.

C.2 YANG module _3gpp-5gs-detnet-node

```
<CODE BEGINS> file "_3gpp-5gs-detnet-node.yang"
module _3gpp-5gs-detnet-node {
  yang-version 1.1;
  namespace "urn:3gpp:node:detnet:_3gpp-5gs-detnet-node";
  prefix _5gs3gppdnet;

  import ietf-detnet {
    prefix dnet;
    reference
      "IETF-RFC-9633";
  }

  organization "3GPP CT3 Working Group";

  contact
    "CT3 WG Web:  <https://www.3gpp.org/3gpp-groups/core-network-terminals-ct/ct-wg3>";

  description
    "_3gpp-5gs-detnet-node module contains an extension of IETF RFC 9633 DetNet YANG module with
    additional parameters defined for interworking with 3GPP 5GS.

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    This version of this YANG module is specified in:
    3GPP TS 29.565 V18.5.0; 5G System;
      Time Sensitive Communication and Time Synchronization Function Services.
    url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.565/";

reference
  "Additional information to this YANG module is specified in:

    3GPP TS 23.501, System architecture for the 5G System (5GS);
    url: https://www.3gpp.org/ftp/Specs/archive/23_series/23.501/

    3GPP TS 23.503, Policy and charging control framework (5GS)
    url: https://www.3gpp.org/ftp/Specs/archive/23_series/23.503/

    3GPP TS 29.513, Policy and Charging Control signalling flows and QoS parameter mapping
    url: https://www.3gpp.org/ftp/Specs/archive/29_series/29.513/";

  revision 2024-12-10 {
    description "version: v1.0.0";
  }

  typedef _3gpp-5gs-node-configuration-status {
    type enumeration {
      enum _3gpp-5gs-node-resource-allocation-success {
        description
          "Successful configuration request.
```

```
            Successful resource allocation within 5GS for the requested configuration";
        }
        enum _3gpp-5gs-node-resource-allocation-failure {
          description
            "Unsuccessful configuration request.
             Failed resource allocation within 5GS for the requested configuration";
        }
        enum _3gpp-5gs-node-port-release {
          description
            "Port release due to the termination of PDU session with the requested
             5GS configuration";
        }
      description
        "_3gpp-5gs-node-configuration-status type identifies the 3GPP specific configuration
         status that may be reported by the 3GPP 5GS node.";
    }

    container _3gpp-5gs-node-requirements {
      description
        "This container defines the maximum delay and/or the maximum loss the 5GS needs to satisfy";
      leaf forwarding-sub-layer {
        type dnet:forwarding-sub-layer-ref;
        description
          "Reference to the forwarding sub-layer that the maximum delay and/or the maximum loss
          applies to";
      }
      leaf _3gpp-5gs-node-max-latency {
        type uint32;
        units "nanoseconds";
        description
          "Maximum latency from 5GS node ingress to 5GS node egress(es) for a single packet of the
          DetNet flow. It is specified as an integer number of nanoseconds";
      }
      leaf _3gpp-5gs-node-max-loss {
        type uint32;
        description
          "Maximum Packet Loss Ration (PLR) parameter for the DetNet service between the 5GS node
          ingress and 5GS node egress(es)";
      }
    }

    container _3gpp-5gs-node-configuration-outcome {
      description
        "This container defines the additional outcome the 5GS may provide to a configuration
        request";
      leaf forwarding-sub-layer {
        type dnet:forwarding-sub-layer-ref;
        description
          "Reference to the forwarding sub-layer the outcome to a configuration request applies to";
      }
      leaf _3gpp-5gs-node-configuration-status {
        type _3gpp-5gs-node-configuration-status;
        description "Changes on configuration status reported by the 3GPP 5GS node";
      }
    }

    container _3gpp-5gs-node-identity {
      description
        "This container defines the 5GS Node identity the 5GS provides to the DetNet controller";
      leaf forwarding-sub-layer {
        type dnet:forwarding-sub-layer-ref;
        description
          "Reference to the forwarding sub-layer that the 5GS node Id applies to";
      }
      leaf _3gpp-5gs-node-id {
        type string;
        description
          "5GS node identity. It is the user-plane node Id handling the traffic of the indicated
           DetNet flows";
      }
    }
}
<CODE ENDS>
```

Annex D (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2021-08						TS skeleton	0.0.0
2021-08	CT3#117e	C3-214576				Inclusion of documents agreed in CT3#117e: C3-214145, C3-214149, C3-214154, C3-214466, C3-214467, C3-214468, C3-214469, C3-214505, C3-214506, C3-214507, C3-214508, C3-214509, C3-214510	0.1.0
2021-10	CT3#118e	C3-215473				Inclusion of documents agreed in CT3#118e: C3-215347, C3-215348, C3-215349, C3-215350, C3-215351, C3-215352, C3-215353, C3-215354, C3-215356, C3-215357, C3-215358, C3-215470	0.2.0
2021-11	CT3#119e	C3-216517				Inclusion of documents agreed in CT3#119e: C3-216114, C3-216115, C3-216116, C3-216121, C3-216397, C3-216398, C3-216399, C3-216400, C3-216401, C3-216402, C3-216426, C3-216594, C3-215357, C3-216595	0.3.0
2021-12	CT#94-e	CP-213208				Presentation for information	1.0.0
2022-01	CT3#119bis-e	C3-220449				Inclusion of documents agreed in CT3#119bis-e: C3-220424, C3-220165, C3-220166, C3-220167, C3-220425, C3-220423, C3-220415, C3-220359, C3-220172	1.1.0
2022-02	CT3#120e	C3-221512				Inclusion of documents agreed in CT3#120e: C3-221181, C3-221184, C3-221185, C3-221186, C3-221187, C3-221189, C3-221190, C3-221191, C3-221192, C3-221237, C3-221445, C3-221446, C3-221469, C3-221552, C3-221606, C3-221650	1.2.0
2022-04	CT3#121e	C3-222482				Inclusion of documents agreed in CT3#121e: C3-222176, C3-222177, C3-222178, C3-222179, C3-222181, C3-222182, C3-222183, C3-222295, C3-222420, C3-222424, C3-222435, C3-222489, C3-222503, C3-222507, C3-222555, C3-222556, C3-222564,	1.3.0
2022-05	CT3#122e	C3-223505				Inclusion of documents agreed in CT3#122e: C3-223121, C3-223122, C3-223124, C3-223126, C3-223229, C3-223230, C3-223131, C3-223132, C3-223283, C3-223286, C3-223469, C3-223471, C3-223472, C3-223490, C3-223494, C3-223495, C3-223660, C3-223661, C3-223693, C3-223739, C3-223744, C3-223749,	1.4.0
2022-06	CT#96	CP-221099				Presentation to TSG CT for approval	2.0.0
2022-06	CT#96	CP-221099				Approved by TSG CT	17.0.0
2022-09	CT#97e	CP-222113	0001	-	F	Add PUT method in table 6.1.3.1-1	17.1.0
2022-09	CT#97e	CP-222113	0002	1	F	Correction to 5G access time distribution	17.1.0
2022-09	CT#97e	CP-222114	0003	1	F	Correction to initial provisioning of TSC related service information	17.1.0
2022-09	CT#97e	CP-222113	0004	-	F	Correction to notification about TSC application session context event	17.1.0
2022-09	CT#97e	CP-222113	0005	-	F	Correction to notification about TSC application session context termination	17.1.0
2020-09	CT#97e	CP-222113	0006	1	F	Correction to subscription to events for the existing TSC application session context	17.1.0
2022-09	CT#97e	CP-222114	0007	1	F	Correction to the procedure of creating a new subscription	17.1.0
2022-09	CT#97e	CP-222113	0009	1	F	Corrections to the methods of Ntsctsf_ASTI Service API	17.1.0
2022-09	CT#97e	CP-222113	0010	1	F	Corrections to the methods of Ntsctsf_QoSandTSCAssistance API	17.1.0
2022-09	CT#97e	CP-222113	0011	-	F	Corrections to the methods of Ntsctsf_TimeSynchronization API	17.1.0
2022-09	CT#97e	CP-222114	0013	1	F	Handling of temporal validity condition	17.1.0
2022-09	CT#97e	CP-222113	0018	-	F	Support of sponsored connectivity	17.1.0
2022-09	CT#97e	CP-222114	0019	1	F	Correction to the references	17.1.0
2022-09	CT#97e	CP-222114	0020	1	F	Correction to time synchronization capabilities subscription	17.1.0
2022-09	CT#97e	CP-222114	0021	1	F	Data Model corrections	17.1.0
2022-09	CT#97e	CP-222114	0022	1	F	Correction of the association of Time Sync Exposure subscriptions to AF sessions	17.1.0
2022-09	CT#97e	CP-222114	0023	1	F	Correction of the handling of AM policies upon Time Sync configuration	17.1.0
2022-09	CT#97e	CP-222114	0024	1	F	TSCTSF API corrections	17.1.0
2022-09	CT#97e	CP-222183	0025	1	F	Mapping of GPSIs and Group Identifiers to a SUPI list	17.1.0
2022-09	CT#97e	CP-222113	0026	-	F	Definitions of HTTP "403 Forbidden" response	17.1.0
2022-09	CT#97e	CP-222113	0027	-	F	Initial provisioning of TSC related service information	17.1.0
2022-09	CT#97e	CP-222121	0028	-	F	Update of info and externalDocs fields	17.1.0
2022-12	CT#98	CP-223181	0029	1	F	Corrections in the error budget calculation	17.2.0

2022-12	CT#98	CP-223181	0030	-	F	Miscellaneous corrections in the Time Synchronization API	17.2.0
2022-12	CT#98	CP-223181	0033	-	F	Correction to Ethernet flows	17.2.0
2022-12	CT#98	CP-223188	0034	-	F	Update of info and externalDocs fields	17.2.0
2022-12	CT#98	CP-223191	0031	-	F	Adding the mandatory error code 502 Bad Gateway	18.0.0
2022-12	CT#98	CP-223192	0032	1	F	TscEvent enumeration definition in the OpenAPI file	18.0.0
2022-12	CT#98	CP-223190	0035	-	F	Update of info and externalDocs fields	18.0.0
2023-03	CT#99	CP-230179	0036	1	B	Adding PER to TSC QoS inputs	18.1.0
2023-03	CT#99	CP-230154	0038	1	A	Correction to Ntsctsf_TimeSynchronization Service	18.1.0
2023-03	CT#99	CP-230154	0040		A	Correction to Ntsctsf_TSCQoSandAssistance Service	18.1.0
2023-03	CT#99	CP-230154	0042		A	Correction to Ntsctsf_ASTI Service	18.1.0
2023-03	CT#99	CP-230174	0043		F	Generalization of QoS monitoring control description	18.1.0
2023-03	CT#99	CP-230179	0044	1	B	Service description – support of network timing synchronization status and reporting	18.1.0
2023-03	CT#99	CP-230179	0045	1	B	Provisioning of coverage area filters for ASTI service	18.1.0
2023-03	CT#99	CP-230179	0046	1	B	Notification of 5G Access Stratum Time Distribution enabled/disabled	18.1.0
2023-03	CT#99	CP-230179	0047		B	Provisioning of coverage area and notification of changes of capabilities configuration	18.1.0
2023-03	CT#99	CP-230175	0048		B	Specification of application errors for TSC QoS requests	18.1.0
2023-03	CT#99	CP-230175	0049	1	B	Indication of Alternative Service Requirements not supported	18.1.0
2023-03	CT#99	CP-230154	0051	1	A	Correction to QoS notification control	18.1.0
2023-03	CT#99	CP-230179	0053	1	B	Support of BAT window and capability for BAT adaptation	18.1.0
2023-03	CT#99	CP-230162	0055		F	Update of info and externalDocs fields	18.1.0
2023-06	CT#100	CP-231143	0057	1	B	Adding PER to QoS service operation description	18.2.0
2023-06	CT#100	CP-231143	0058	1	B	Network determined BAT offset and periodicity adaption	18.2.0
2023-06	CT#100	CP-231143	0059	1	B	The correction on the BAT window and BAT adaptation capability	18.2.0
2023-06	CT#100	CP-231127	0060	3	B	Support for network timing synchronization status and reporting	18.2.0
2023-06	CT#100	CP-231131	0061	1	F	Adding missing presence conditions	18.2.0
2023-06	CT#100	CP-231149	0062	3	B	Support of traffic characteristics and monitoring of performance characteristics	18.2.0
2023-06	CT#100	CP-231143	0065	3	F	Adding description for controlling time synchronization service	18.2.0
2023-06	CT#100	CP-231180	0068	1	A	Correction on setting Packet Delay Failure report Threshold	18.2.0
2023-06	CT#100	CP-231134	0071	1	F	Adding the time domain to procedures for provisioning TSC information	18.2.0
2023-06	CT#100	CP-231131	0072		F	Corrections to the redirection mechanism description	18.2.0
2023-06	CT#100	CP-231151	0073	1	B	3GPP extensions to DetNet YANG model to support 5GS specifics	18.2.0
2023-06	CT#100	CP-231151	0074	1	B	Definition of 3gpp-5gs-detnet-node YANG file	18.2.0
2023-06	CT#100	CP-231141	0075		F	Update of info and externalDocs fields	18.2.0
2023-09	CT#101	CP-232105	0077	1	B	TSCTSF handling when it receives the time sync request from AF and subscription from UDM and the data model definition	18.3.0
2023-09	CT#101	CP-232098	0078		F	Remove the trailing slash in the relative path after API URI	18.3.0
2023-09	CT#101	CP-232185	0079	2	F	Corrections to the definition of AF requested QoS for a UE or group of UEs	18.3.0
2023-09	CT#101	CP-232098	0080		F	Corrections to the redirection mechanism description	18.3.0
2023-09	CT#101	CP-232098	0081		F	Update the apiVersion in the QoSandTSCAssistance Service API	18.3.0
2023-09	CT#101	CP-232105	0082	1	B	Resource and data model for the Ntsctsf_ASTI API	18.3.0
2023-09	CT#101	CP-232105	0083	1	B	Service description for the Ntsctsf_ASTI service	18.3.0
2023-09	CT#101	CP-232085	0084	-	F	Update of info and externalDocs fields	18.3.0
2023-12	CT#102	CP-233245	0086	1	F	Reslove the EN about AF requested QoS for a UE or group of UE(s)	18.4.0
2023-12	CT#102	CP-233228	0087		F	HTTP RFCs obsoleted by IETF RFC 9113	18.4.0
2023-12	CT#102	CP-233200	0088	2	B	Support the status information on ASTI service	18.4.0
2023-12	CT#102	CP-233248	0089	1	B	Clarification on time synchronization service	18.4.0
2023-12	CT#102	CP-233266	0091	3	B	Solving remaining Editor's Note(s) for DetNet	18.4.0
2023-12	CT#102	CP-233248	0092	1	B	Correction to clock quality information	18.4.0
2023-12	CT#102	CP-233248	0094	1	B	Update to the time synchronization status and the report	18.4.0
2023-12	CT#102	CP-233248	0095	1	F	Removal of Editor’s Note	18.4.0
2023-12	CT#102	CP-233229	0096	1	F	ProblemDetails RFC 7807 obsoleted by RFC 9457	18.4.0
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2024-03	CT#103	CP-240175	0103	1	B	Notifying the clock quality acceptance criteria result for NW TT	18.5.0
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2024-03	CT#103	CP-240207	0108		F	Corrections to DetNet data model	18.5.0
2024-03	CT#103	CP-240175	0109	1	B	Corrections and alignments of TimeSyncExposure service data model	18.5.0
2024-03	CT#103	CP-240175	0110	1	B	Corrections and alignments to ASTI service data model	18.5.0
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2024-06	CT#104	CP-241102	0113	1	F	Correction to the definition of Ntsctsf_QoSandTSCAssistance API	18.6.0
2024-06	CT#104	CP-241102	0114	1	B	Clarification about 200/201 response for time synchronization service	18.6.0
2024-06	CT#104	CP-241104	0117	1	A	Corrections on QoS monitoring reports	18.6.0
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2024-06	CT#104	CP-241102	0122	3	F	Clean up of subscription control and ASTI status monitoring	18.6.0
2024-06	CT#104	CP-241103	0123	2	F	Various GMEC related corrections	18.6.0
2024-06	CT#104	CP-241104	0124	3	A	Correction of the presence condition for qosReference	18.6.0
2024-06	CT#104	CP-241104	0128	1	A	Corrections on Ntsctsf_TimeSynchronization and Annex number	18.6.0
2024-06	CT#104	CP-241093	0129		F	Corrections on the apiVersion	18.6.0
2024-06	CT#104	CP-241103	0130	1	F	Additional GMEC related corrections	18.6.0
2024-06	CT#104	CP-241094	0131	1	F	Corrections to the 3xx based 3GPP SBI redirection mechanism	18.6.0
2024-06	CT#104	CP-241103	0132	1	F	Correction to Individual QoS parameters	18.6.0
2024-06	CT#104	CP-241102	0133	2	F	Correction of the description of the attribute periodicityRange	18.6.0
2024-06	CT#104	CP-241104	0135		A	Correct the Cardinality of the TscAppSessionContextUpdateData	18.6.0
2024-06	CT#104	CP-241104	0137	1	A	Corrections for the Ntsctsf_TimeSynchronization	18.6.0
2024-06	CT#104	CP-241086	0139		F	Update of info and externalDocs fields	18.6.0
2024-09	CT#105	CP-242141	0142	1	A	Wrong scope name	18.7.0
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2024-12	CT#106	CP-243110	0158		A	Corrections on the N6 termination indication	18.8.0
2024-12	CT#106	CP-243120	0160	1	F	Updating the IETF HTTP RFC for DetNet	18.8.0
2024-12	CT#106	CP-243146	0163		F	Update of info and externalDocs fields	18.8.0
2025-03	CT#107	CP-250122	0165		F	Correct the RFC reference for the Yang Module	18.9.0

History

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